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A Practical Book for Quantity Surveying

Procedure of Concrete, Shuttering, Reinforcement and Finish work calculations

Author
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For Civil Engineers

(in FPS system)

A book for Civil Engineers

A Practical book for

Quantity Surveying

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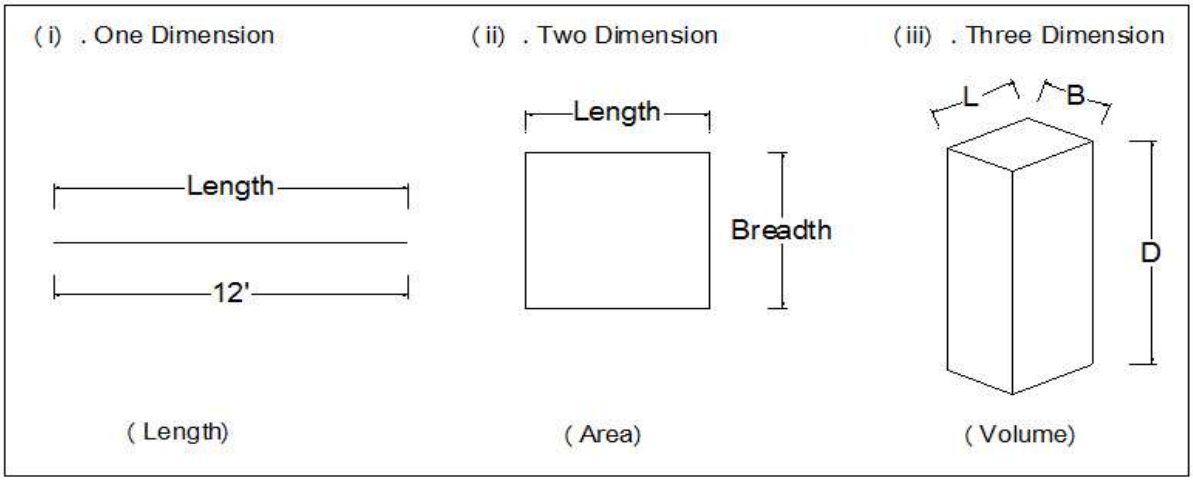
CONTENTS

UNIT CONVERSION

(I). One dimension calculation = length calculation

(ii). Two dimension calculation = area calculation

(iii). Three dimension calculation = volume calculation



Types of units :-

1. M.K.S Units (Metre-Kilogram/Sec) : Metres, Centimetres & Millimetres (Scales used).
These units are practically called as Engineering Unit.

2. F.P.S Units (Foot-Pound/Sec) : Feets, Inches and Yards (scales used).
These units are practically called as Architectural Unit.

S.no.	Scale	One-Dimension	Two-Dimension	Three-Dimension
		Length	Area	Volume
1	Metre	M	m x m = m^2 / square metre	m x m x m = m^3 / cum
2	Centimeter	CM	cm x cm = cm^2 / sq. centimetre	cm x cm x cm = cm^3 /cucm
3	Millimeter	MM	mm x mm = mm^2/sq. millimetre	mm x mm x mm = mm^3/cumm
4	Feet	FT	Ft x Ft = Ft^2 / square feet	Ft x Ft x Ft = Ft^3/cft
5	Inch	INCH	inch x inch = $inch^2$ / square inch	inch x inchx inch = $inch^3$/cuinch
6	Yard	YD	Yd x Yd = Yd^2/ square yard	Yd x Yd x Yd = Yd^3/cuyd

Scales :-

1 metre = 1000mm	1 yd = 36"	1 Feet = 12"
1 metre = 100cm	1 yd = 3'	1 inch = 2.54cm
1 cm = 10mm	1 yd^2 = 9 Ft^2	1 inch = 25.4mm
1 metre = 1.0936 yd	1 Acre = 4840 yd^2	1 metre = 39.37"
1 metre = 3.28 Ft	1 Hectare = 2.47 Acre	

S.no	One-Dimension	Two-Dimension	Three-Dimension
	Length	Area	Volume
1	6m = ? Mm	$6m^2$ = ? Mm^2	$6m^3$ = ? Mm^3
	Since 1m = 1000mm	Since 1m = 1000mm	Since 1m = 1000mm
	6 x 1000 = 6000mm	6 x 1000^2 = 6000000mm^2	6 x 1000^3 = 6000000000mm^3
2	25m = ? Cm	$25m^2$ = ? Cm^2	$25m^3$ = ? Cm^3
	Since 1m = 100cm	Since 1m = 100cm	Since 1m = 100cm
	25 x 100 = 2500cm	25 x 100^2 = 250000cm^2	25 x 100^3 = 25000000cm^3
3	60m = ? Yd	$60m^2$ = ? Yd^2	$60m^3$ = ? Yd^3
	Since 1m = 1.0936yd	Since 1m = 1.0936yd	Since 1m = 1.0936yd
	60 x 1.0936 = 65.616yd	60 x 1.0936^2 = 71.757yd2	60 x 1.0936^3 = 78.474yd^3
4	0.20m = ? Ft	$0.20m^2$ = ? Ft^2	$0.20m^3$ = ? Ft^3
	Since 1m = 3.28Ft	Since 1m = 3.28Ft	Since 1m = 3.28Ft
	0.20 x 3.28 = 0.656Ft	0.20 x 3.28^2 = 2.151Ft^2	0.20 x 3.28^3 = 7.057Ft^3
5	55m = ? Inch	$55m^2$ = ? $Inch^2$	$55m^3$ = ? $Inch^3$
	Since 1m = 39.37"	Since 1m = 39.37"	Since 1m = 39.37"
	55 x 39.37 = 2165.35"	55 x 39.37^2 = 85249.829^2"	55 x 39.37^3 = 3356285.787"^{3}
6	9000mm = ? M	$9000mm^2$ = ? M^2	$9000mm^3$ = ? M^3
	Since 1m =1000mm	Since 1m = 1000mm	Since 1m = 1000mm
	9000/1000 = 9.0m	9000/1000^2 = 0.009m^2	9000/1000^3 = 9.0x$10^{-6}m^3$
7	2500mm = ? Cm	$2500mm^2$ = ? Cm^2	$2500mm^3$ = ? Cm^3
	Since 1 cm = 10mm	Since 1 cm = 10mm	Since 1 cm = 10mm
	2500/10 = 250cm	2500/10^2 = 25cm^2	2500/10^3 = 2.5cm^3
8	600mm = ? Inch	$600mm^2$ = ? $Inch^2$	$600mm^3$ = ? $Inch^3$
	Since 1" = 25.4mm	Since 1" = 25.4mm	Since 1" = 25.4mm
	600/25.4 = 23.622"	600/25.4^2 = 0.93^2"	600/25.4^3 = 0.0366"^{3}
9	2800mm = ? Ft	$2800mm^2$ = ? Ft^2	$2800mm^3$ = ? Ft^3
	Since 1" = 25.4mm	Since 1" = 25.4mm	Since 1" = 25.4mm
	2800/25.4 = 110.236"	2800/25.4^2 = 4.34"^{2}	2800/25.4 ^{3}= 0.170"^{3}
	Since 1Ft = 12inch	Since 1Ft = 12inch	Since 1Ft = 12inch

S.no	One-Dimension	Two-Dimension	Three-Dimension
	Length	Area	Volume
	110.236/12 = 9.186 Ft	$4.34/12^2 = 0.030\ Ft^2$	$0.170/12^3 = 9.83x10^{-3}\ Ft^3$
10	3500mm = ? Yd	$3500mm^2 = ?\ Yd^2$	$3500mm^3 = ?\ Yd^3$
	Since 1" = 25.4mm	Since 1" = 25.4mm	Since 1" = 25.4mm
	3500/25.4 = 137.795"	$3500/25.4^2 = 5.425"^2$	$3500/25.4^3 = 0.213"^3$
	Since 1yd = 36inch	Since 1yd = 36inch	Since 1yd = 36inch
	137.795/36 = 3.827yd	$5.425/36^2 = 4.18x10^{-3}yd^2$	$0.213/36^3 = 4.57x10^{-6}yd^3$
11	10cm = ? Mm	$10cm^2 = ?\ Mm^2$	$10cm^3 = ?\ Mm^3$
	Since 1cm = 10mm	Since 1cm = 10mm	Since 1cm = 10mm
	10 x 10 = 100mm	$10 \times 10^2 = 1000mm^2$	$10 \times 10^3 = 10000mm^3$
12	560cm = ? M	$560cm^2 = ?\ M^2$	$560cm^3 = ?\ M^3$
	Since 1m = 100cm	Since 1m = 100cm	Since 1m = 100cm
	560/100 = 5.6m	$560/100^2 = 0.056m^2$	$560/100^3 = 5.6x10^{-4}m^3$
13	650cm = ? Inch	$650cm^2 = ?\ Inch^2$	$650cm^3 = ?\ Inch^3$
	Since 1inch = 2.54cm	Since 1inch = 2.54cm	Since 1inch = 2.54cm
	650/2.54 = 255.905"	$650/2.54^2 = 100.75"^2$	$650/2.54^3 = 39.665"^3$
14	5206cm = ? Yd	$5206cm^2 = ?\ Yd^2$	$5206cm^3 = ?\ Yd^3$
	Since 1inch = 2.54cm	Since 1inch = 2.54cm	Since 1inch = 2.54cm
	5206/2.54 = 2049.606"	$5206/2.54^2 = 806.931"^2$	$5206/2.54^3 = 317.689"^3$
	Since 1yd = 36inch	Since 1yd = 36inch	Since 1yd = 36inch
	2049.606/36 = 56.933yd	$806.931/36^2 = 0.622yd^2$	$317.689/36^3 = 6.8x10^{-3}yd^3$
15	950cm = ? Ft	$950cm^2 = ?\ Ft^2$	$950cm^3 = ?\ Ft^3$
	Since 1" = 2.54cm	Since 1" = 2.54cm	Since 1" = 2.54cm
	950/2.54 = 374.0157"	$950/2.54^2 = 147.25"^2$	$950/2.54^3 = 57.972"^3$
	Since 1Ft = 12"	Since 1Ft = 12"	Since 1Ft = 12"
	374.0157/12 = 31.167Ft	$147.25/12^2 = 1.02Ft^2$	$57.972/12^3 = 0.0335Ft^3$
16	0.25Ft = ? Mm	$0.25Ft^2 = ?\ Mm^2$	$0.25Ft^3 = ?\ Mm^3$
	Since 1ft = 12"	Since 1ft = 12"	Since 1ft = 12"
	0.25 x 12 = 3"	$0.25 \times 12^2 = 36"^2$	$0.25 \times 12^3 = 432"^3$

S.no	One-Dimension	Two-Dimension	Three-Dimension
	Length	Area	Volume
	Since 1inch = 25.4mm	Since 1inch = 25.4mm	Since 1inch = 25.4mm
	3 x 25.4 = 76.2mm	36 x 25.4^2 = 23225.76mm^2	432 x 25.4^3 = 7079211.648mm^3
17	60Ft = ? cm	60Ft^2 = ? cm^2	60Ft^3 = ? cm^3
	Since 1' = 12"	Since 1' = 12"	Since 1' = 12"
	60 x 12 = 720"	60 x 12^2 = 8640$"^2$	60 x 12^3 = 103680$"^3$
	Since 1" = 2.54cm	Since 1" = 2.54cm	Since 1" = 2.54cm
	720 x 2.54 = 1828.8cm	8640 x 2.54^2 = 55741.824cm^2	103680 x 2.54^3 = 1699010.7cm^3
18	56Ft = ? Inch	56Ft^2 = ? $Inch^2$	56Ft^3 = ? $Inch^3$
	Since 1Ft = 12"	Since 1Ft = 12"	Since 1Ft = 12"
	56 x 12 = 672"	56 x 12^2 = 8064$"^2$	56 x 12^3 = 96768$"^3$
19	12Ft = ? M	12Ft^2 = ? M^2	12Ft^3 = ? M^3
	Since 1m = 3.28ft	Since 1m = 3.28ft	Since 1m = 3.28ft
	12/3.28 = 3.658m	12/3.28^2 = 1.115m^2	12/3.28^3 = 0.34m^3
20	355Ft = ? Yd	355Ft^2 = ? Yd^2	355Ft^3 = ? Yd^3
	Since 1yd = 3ft	Since 1yd = 3ft	Since 1yd = 3ft
	355/3 = 118.333yd	355/3^2 = 39.444yd^2	355/3^3 = 13.148yd^3
21	25yd = ? M	25yd^2 = ? M^2	25yd^3 = ? M^3
	Since 1m = 1.0936yd	Since 1m = 1.0936yd	Since 1m = 1.0936yd
	25/1.0936 = 22.860m	25/1.0936^2 = 20.903m^2	25/1.0936^3 = 19.114m^3
22	2yd = ? Cm	2yd^2 = ? Cm^2	2yd^3 = ? Cm^3
	Since 1yd = 36"	Since 1yd = 36"	Since 1yd = 36"
	2 x 36 = 72"	2 x 36^2 = 2592$"^2$	2 x 36^3 = 93312$"^3$
	since 1" = 2.54cm	since 1" = 2.54cm	since 1" = 2.54cm
	72 x 2.54 = 182.88cm	2592 x 2.54^2 = 16722.547cm^2	93312 x 2.54^3 = 1529109.71cm^3
23	5.0 yd = ? Mm	5.0 yd^2 = ? Mm^2	5.0 yd^3 = ? Mm^3
	Since 1yd = 36"	Since 1yd = 36"	Since 1yd = 36"
	5 x 36 = 180"	5 x 36^2 = 6480$"^2$	5 x 36^3 = 233280"
	since 1" = 25.4mm	since 1" = 25.4mm	since 1" = 25.4mm

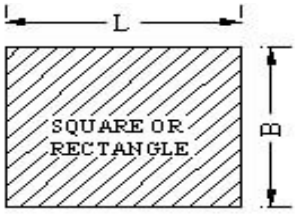
S.no	One-Dimension	Two-Dimension	Three-Dimension
	Length	Area	Volume
	180 x 25.4 = 4572mm	6480 x 25.4^2 = 4180636.8mm^2	23380 x 25.4^3 = 3822774290mm^3
24	2yd = ? Inch	$2yd^2$ = ? $Inch^2$	$2yd^3$ = ? $Inch^3$
	Since 1yd = 36"	Since 1yd = 36"	Since 1yd = 36"
	2 x 36 = 72"	2 x 36^2 = 2592"^{2}	2 x 36^3 = 93312"^{3}
25	25yd = ? Ft	$25yd^2$ = ? Ft^2	$25yd^3$ = ? Ft^3
	Since 1yd = 3ft	Since 1yd = 3ft	Since 1yd = 3ft
	25 x 3 = 75Ft	25 x 3^2 = 225Ft^2	25 x 3^3 = 675Ft^3
26	20" = ? Mm	20"^{2} = ? Mm^2	20"^{3} = ? Mm^3
	Since 1"= 25.4mm	Since 1" =25.4mm	Since 1" 25.4mm
	20 x 25.4 = 508mm	20 x 25.4^2 = 12903.2mm^2	20 x 25.4^3 = 327741.28mm^3
27	15" = ? Cm	15"^{2} = ? Cm^2	15"^{3} = ? Cm^3
	Since 1" = 2.54cm	Since 1" = 2.54cm	Since 1" = 2.54cm
	15 x 2.54 = 39.1cm	15 x 2.54^2 = 96.774cm^2	15 x 2.54^3 = 245.805cm^3
28	260" = ? M	260"^{2} = ? M^2	260"^{3} = ? M^3
	since 1m = 39.37"	since 1m = 39.37"	since 1m = 39.37"
	260/39.37 = 6.604m	$260/39.37^2$ = 0.167m^2	$260/39.37^3$ = 4.26x$10^{-3}m^3$
29	20" = ? Yd	20"^{2} = ? Yd^2	20"^{3} = ? Yd^3
	Since 1yd = 36"	Since 1yd = 36"	Since 1yd = 36"
	20/36 = 0.555yd	$20/36^2$ = 0.015yd^2	$20/36^3$ = 4.28x$10^{-4}yd^3$
30	6" =? Ft	6"^{2} =? Ft^2	6"^{3} =? Ft^3
	Since 1' = 12"	Since 1' = 12"	Since 1' = 12"
	6/12 = 0.5Ft	$6/12^2$ = 0.0416Ft^2	$6/12^3$ = 3.47x$10^{-3}Ft^3$
31	6'6" = ? Ft		
	Since 1' = 12"		
	6/12 = 0.5'	---	---
	6' + 0.5' = 6.5'		

S.no	One-Dimension	Two-Dimension	Three-Dimension
	Length	Area	Volume
32	9'9" = ? Inch		
	Since 1ft = 12"		
	9 x 12 = 108"	---	---
	108" + 9" = 117"		
33	6'5" = ? Cm		
	Since 1' = 12"		
	6 x 12 = 72"		
	72 + 5" = 77"	---	---
	77" = ? Cm		
	Since 1" = 2.54cm		
	77 x 2.54 = 195.58cm		
34	9'1/4" = ? Yd		
	1/4 = 0.25 "		
	9'0.25" = ? Yd		
	Since 1' = 12"	---	---
	9 x 12 = 108"		
	108"+.025" = 108.25"		
	108.25" = ? Yd		
	Since 1yd = 36"		
	108.25/36 = 3.006yd		
35	10'3/4" = ? M		
	3/4 = 0.75"		
	10'0.75" = ? M		
	Since 1' = 12"	---	---
	10 x 12 = 120"		
	120" + 0.75" = 120.75"		
	120.75" = ? M		
	Since 1m = 39.37"		
	120.75/39.37 = 3.067m		

LENGTH AND AREA CALCULATION FORMULAS

Formulas:

1. Square or Rectangle

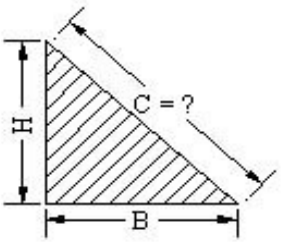


(i) Area = A = L x B

(ii) Peripheral Length = L = (L+B) x 2

2. Pythagoras theorem

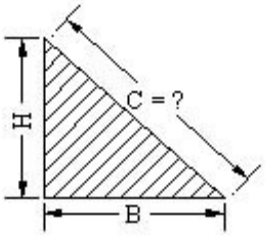
this theorem is used to find out any inclined length



$c^2 = a^2 + b^2$

$c = V(a^2 + b^2)$

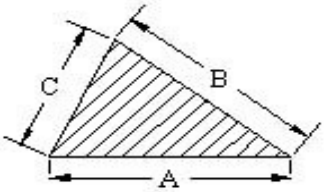
3. Tri-angle



(i) Area = A = 1/2 x B x H

(ii) Peripheral Length = L = B + H + C

4. Irregular Tri-angle

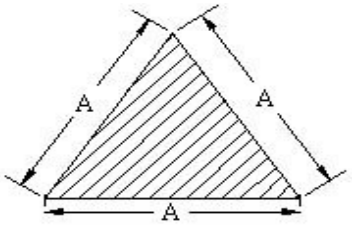


(i) Area = A = V (s(s-a) (s-b) (s-c))

where s = (a + b + c)/2

(ii) Peripheral Length = L = a + b + c

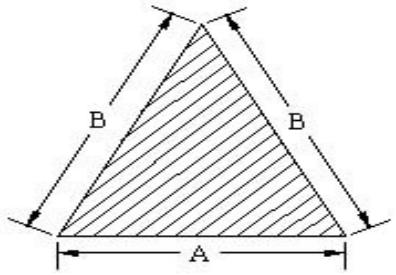
5. Equilateral Tri-angle



(i) Area = A = $(a^2/4)$ x V3

(ii) Peripheral Length = L = a + a + a = 3a

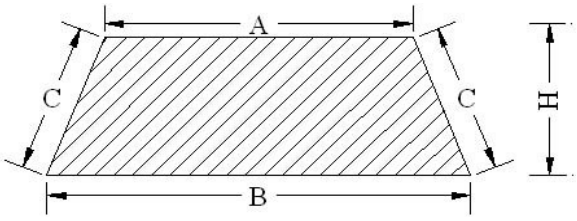
6. Isosceles Tri-angle



(i) Area = A = (a/4) x V $4b^2$-a^2

(ii) Peripheral Length = L = a + b + b = a + 2b

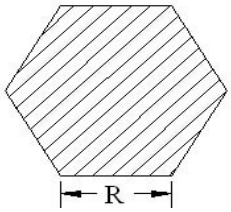
7. Trapezoidal



(i) Area = A = 1/2 (a+ b) x h

(ii) Peripheral Length = L = a + b + c + c

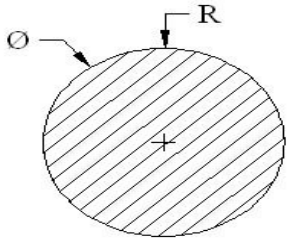
8. Hexagon



(i) Area = A = (0.5 x r x 0.5 x r x Tan60) x 6

(ii) Peripheral Length = L = 6r

9. Circle



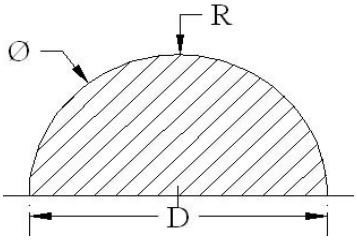
(i) Area = A = π/4 x d^2

where d = diameter of circle ; π = 3.14

(ii) Peripheral Length = L = 2 x π x r

where r = radius of circle

10. Semi-Circle



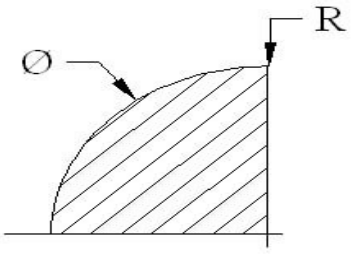
(i) Area = A = π/4 x d^2 x 0.50

where d = diameter of circle ; π = 3.14

(ii) Peripheral Length = L = 2 x π x r x 0.50

where r = radius of circle

11. Quarter Circle



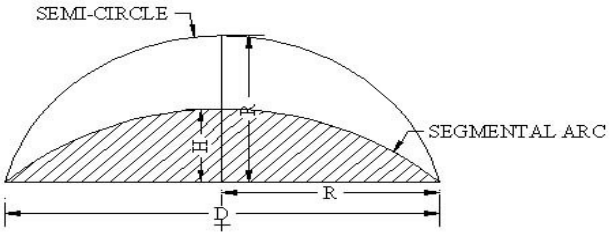
(i) Area = A = $\pi/4 \times d^2 \times 0.25$

where d = diameter of circle ; $\pi = 3.14$

(ii) Peripheral Length = L = $2 \times \pi \times r \times 0.25$

where r = radius of circle

12. Segmental Arc



(i) Area = A = $(2/3 \times D \times H) + (H^3/2D)$

where d = diameter of circle

H = height of arc

(ii) Arc Length = L = (8b - 2r)/3

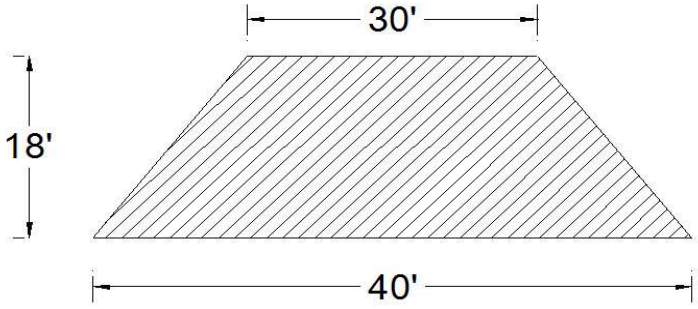
where 'r' = radius of circle

b' = V $(r^2 + h^2)$

PLOT AREA CALCULATION

Problem-1:

find area of plot = ?



Solution: the area of plot can be find out by using

trapezoidal area formula i. e

area = 1/2 x [a+ b] x h

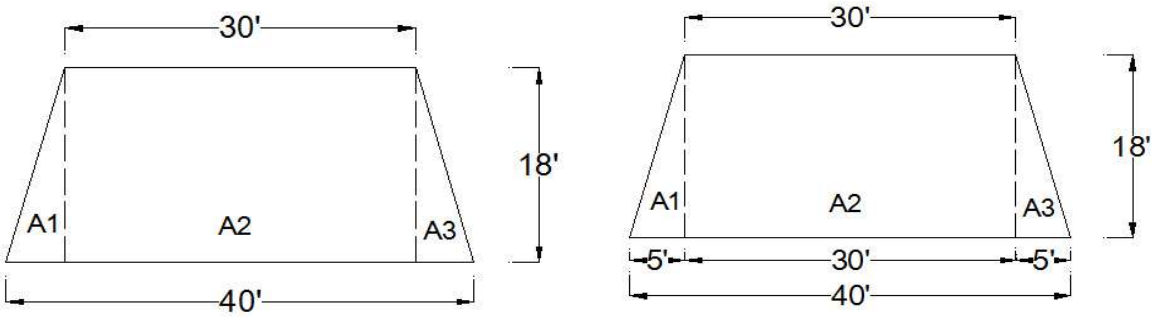
area = 0.5 x [30 + 40] x 18

area = 630.0 Ft^2

Method - ii :

Area of plot can be found out by using thumb rule i.e.

dividing area in to parts



A1 = Area-1 = 0.5 x 5 x 18 .= 45.0 Ft^2

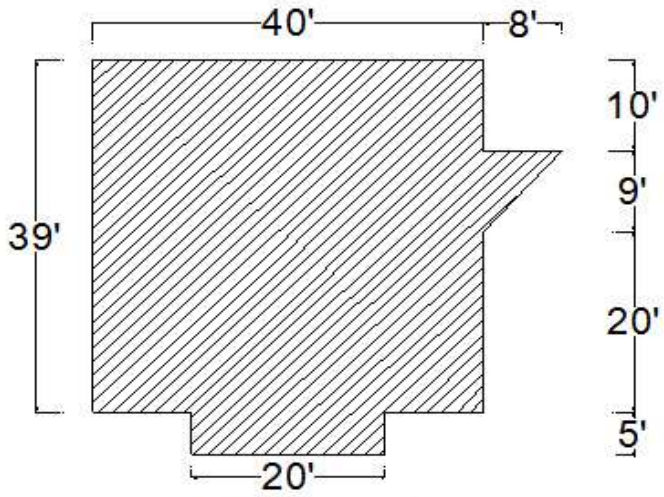
A2 = Area-2 = 30 x 18 .= 540.0 Ft^2

A3 = Area-3 = 0.5 x 5 x 18 .= 45.0 Ft^2

total area of plot .= 630.0 Ft^2

Problem-2:

find area of plot = ?



PLAN OF PLOT

Solution:

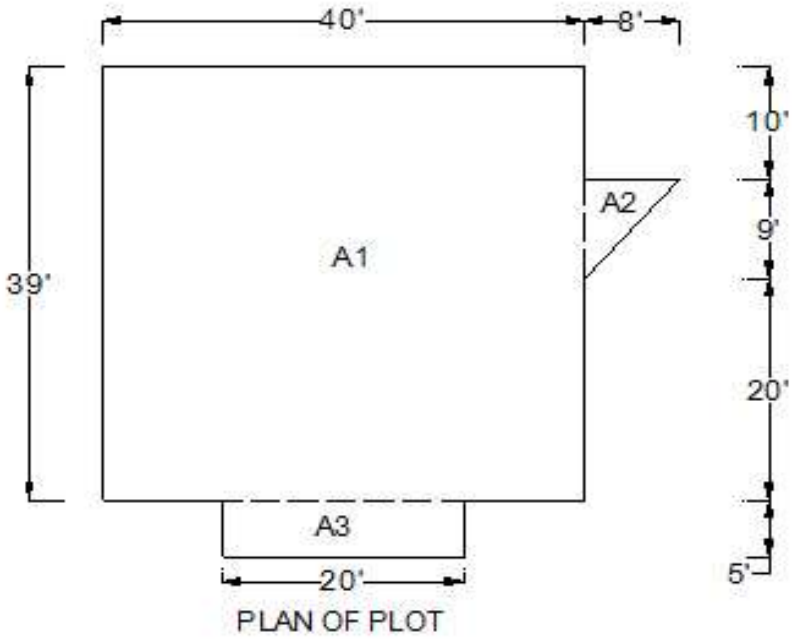
Area of plot can be found out by using thumb rule i.e dividing area in to parts.

A1 = Area-1 = 40 x 39 .= 1560.0 Ft^2

A2 = Area-2 = 0.5 x 8 x 9 .= 36.0 Ft^2

A3 = Area-3 = 20 x 5 .= 100.0 Ft^2

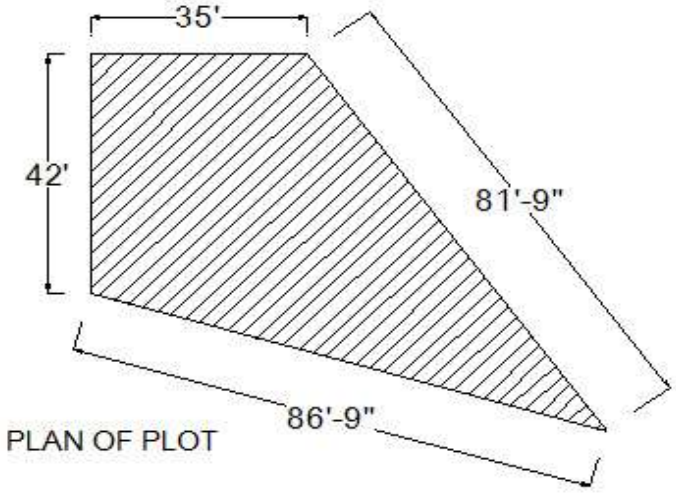
total area of plot .= 1696.0 Ft^2



PLAN OF PLOT

Problem-3:

find area of plot = ?



PLAN OF PLOT

Solution: Area of plot can be found out by using thumb rule i.e. dividing area in to parts

A1 = Area-1 = 0.5 X 35 X 42 = 735.0 Ft^2

A2 = Area-2 = V S(S-A) (S-B) (S-C)

where s = (a + b + c)/2

By pythogorous theorem

$C = V(a^2 + b^2)$

$C = V(35^2 + 42^2)$

C= 54.671

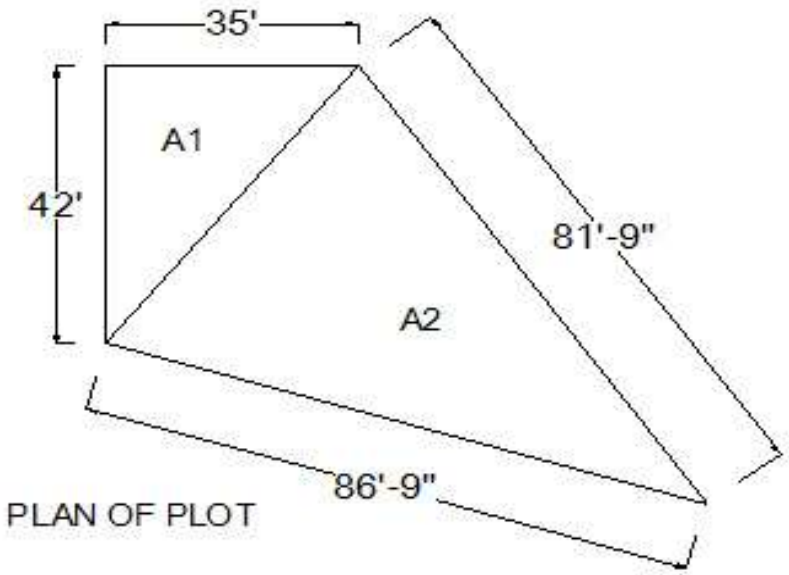
S = (86.75 + 81.75 + 54.671) / 2

S = 111.585

A2 = Area-2 = V 111.585(111.585-86.75) (111.585-81.75) (111.585-54.671)

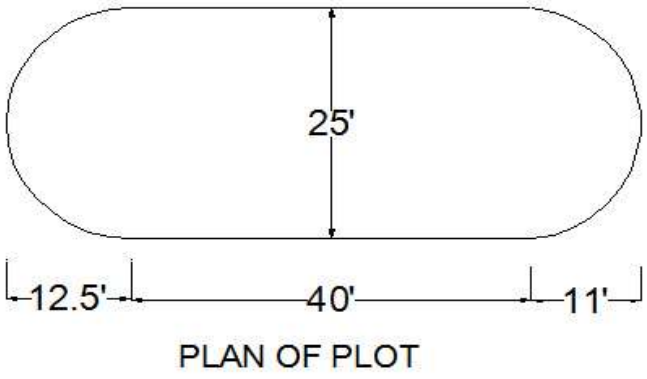
A2 = Area-2 = 2169.239 Ft^2

Total area of plot = A1 + A2 = 2904.239 Ft^2

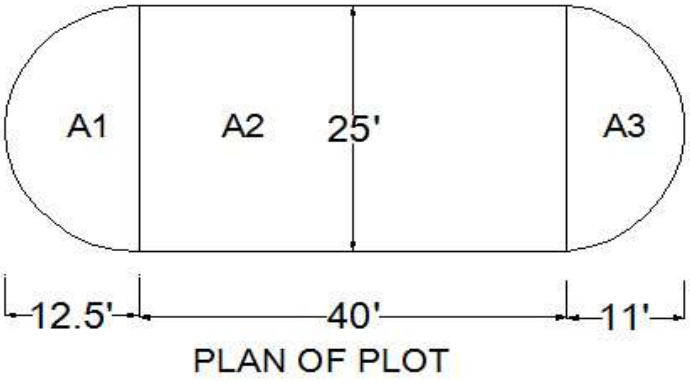


Problem-4 :

find area of plot = ?



Solution: Area of plot can be found out by using thumb rule i.e. dividing area in to parts



Area-1 = A1 = area of semi-circle = $\pi/4 \times d^2 \times 0.50 = \pi/4 \times 25^2 \times 0.50 = 245.436\ Ft^2$

Area-2 = A2 = area of rectangle = $L \times B = 40 \times 25 = 1000\ Ft^2$

Area-3 = A3 = area of segmental arc = $(2/3 \times D \times H) + (H^3/2D)$

$.= (2/3 \times 25 \times 11) + (11^3 / 2 \times 25)$

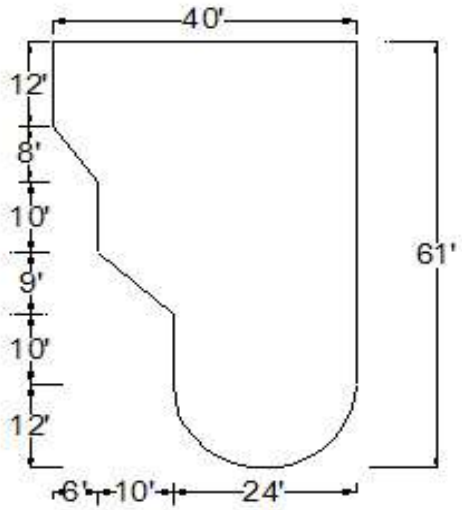
$.= 183.333 + 26.62$

$.= 209.953\ Ft^2$

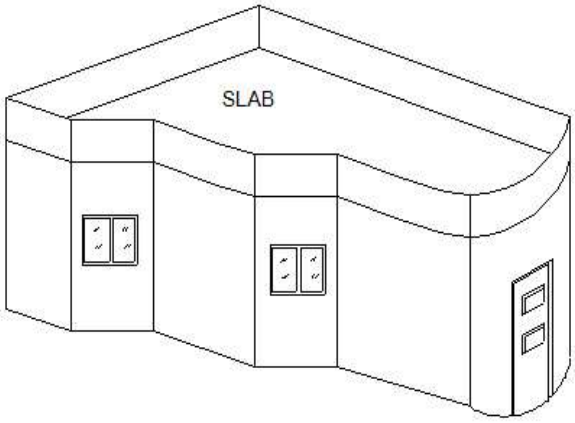
Total area of plot = A1 + A2 + A3 = $1455.389\ Ft^2$

Problem-5:

find area of Slab = ?



PLAN OF SLAB



Solution: Area of slab can be found out by using thumb rule i.e. dividing area in to parts

Area-1 = A1 = area of rectangle = $L \times B = 40 \times 12 = 480.0\ Ft^2$

Area-2 = A2 = area of triangle = $0.5 \times L \times B = 0.5 \times 8 \times 6 = 24.0\ Ft^2$

Area-3 = A3 = area of rectangle = $L \times B = 34 \times 18 = 612.0\ Ft^2$

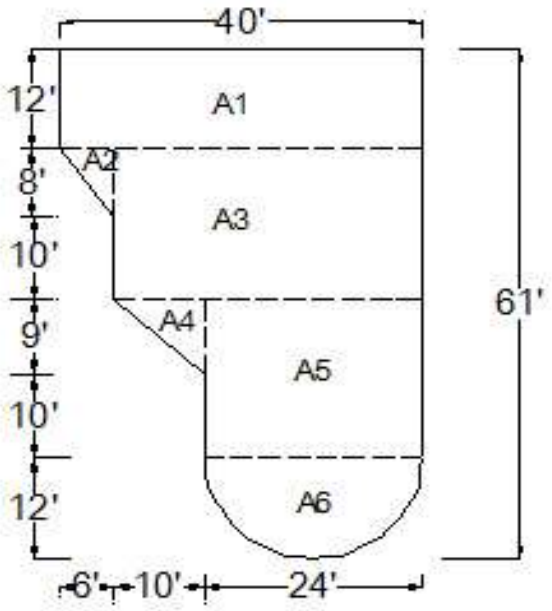
Area-4 = A4 = area of triangle = $0.5 \times L \times B = 0.5 \times 9 \times 10 = 45.0\ Ft^2$

Area-5 = A5 = area of rectangle = $L \times B = 24 \times 19 = 456.0\ Ft^2$

Area-6 = A6 = area of semi-circle = $\pi/4 \times d^2 \times 0.50 = \pi/4 \times 24^2 \times 0.50 = 226.194\ Ft^2$

Total area of Slab = A1 + A2 + A3 + A4 + A5 + A6

$.= 1843.194\ Ft^2$



PLAN OF SLAB

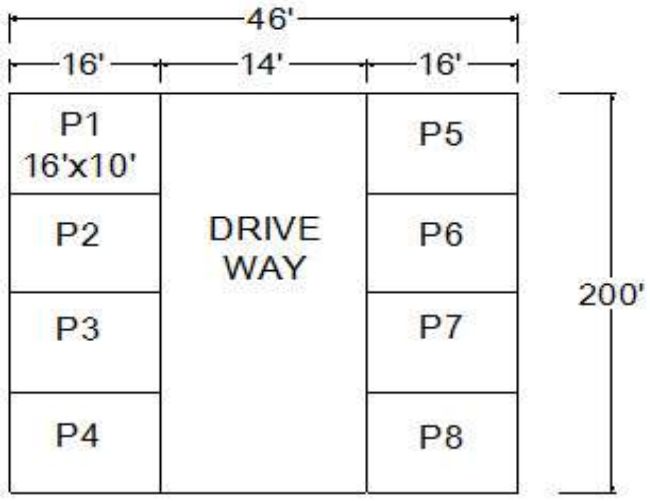
Problem-6:

From the given figure find no. of car-parking space

If size of plot = 46' x 200' and

size of each car park space = 16' x 10'

Size of Drive-way = 14' x 200'



PLAN OF CAR PARKING AREA

Solution :-

1. Plot area = 46' x 200' = 9200 Ft^2

2. Drive-way area = 14' x 200' = 2800.0 Ft^2

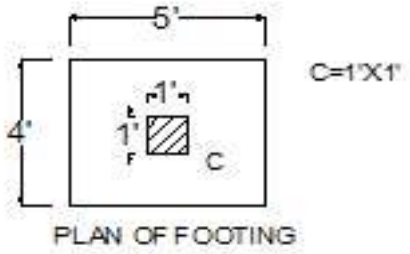
3. Car-parking space = Plot area - Drive-way area
   .= 9200 - 2800
   .= 6400 Ft^2

4. Area of each Car-park space = 16' x 10' = 160Ft^2

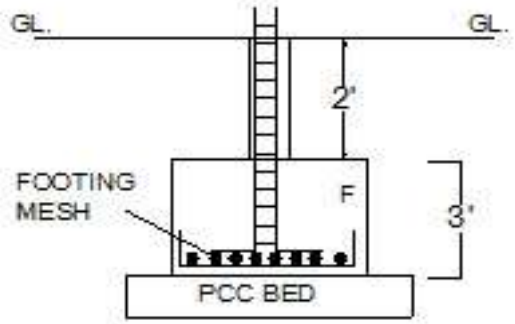
5. No. of Car-park space to be provided = Car-park space / area of each Car-park space
   .= 6400 / 160
   .= 40 Car-park space can be provided

CENTERING AND SHUTTERING AREA CALCULATION

Problem-1: find area of Centering and Shuttering for footing = ?
If size of footing = 5' x 4' x 3'



PLAN OF FOOTING



SECTION DWG.

Solution:

Note:

area will be counted for wooden shuttering and as well as for laying footing steel mesh.

Centering and Shuttering area = Side area + Bottom area

.= Peripheral Length x Depth + Bottom area

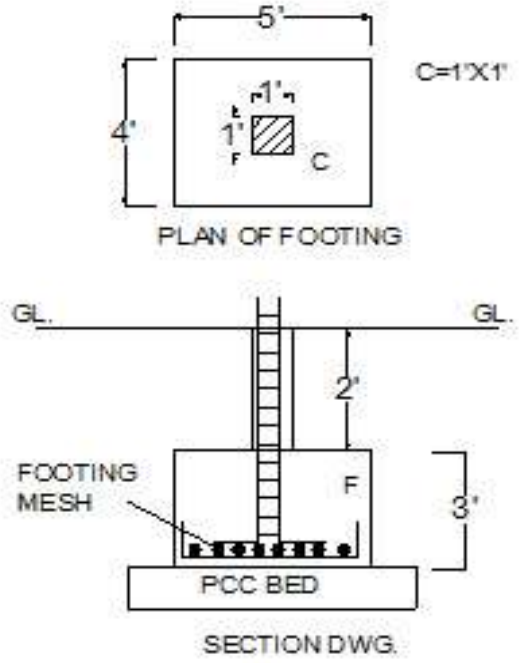
.= (L + B) x 2 x D + L x B

.= (5 + 4) x 2 x 3 + 5 x 4

.= 74.0 Ft^2

Problem-2: find area of Centering and Shuttering for Neck Column = ?

If size of neck column = 1' x 1' x 2' and size of footing = 5' x 4' x 3'



Solution:

Note:

area will be counted for wooden shuttering and as well as for laying neck column steel. Depth of Neck column shall be considered up to footing mesh, as steel bars of neck column rests on footing mesh.

Centering and Shuttering area = Side area

.= Peripheral Length x Depth

.= (L + B) x 2 x D

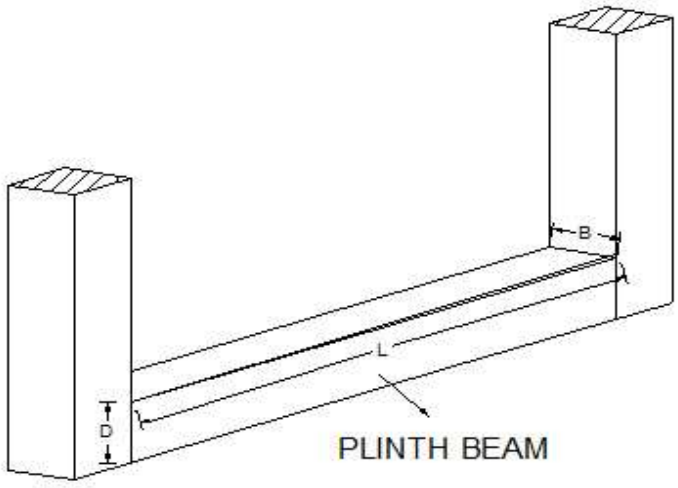
.= (1 + 1) x 2 x 5

.= 20.0 Ft^2

Problem-3:

Find area of Centering and Shuttering for Plinth beam = ?

If size of Plinth beam = 12' x 0.75' x 1'



Solution:

Note:

area will be counted for wooden shuttering and as well as for laying Plinth beam steel.

Centering and Shuttering area = Side area + Bottom area

.= L x D x 2 + L x B

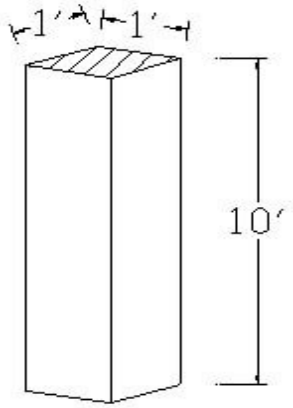
.= 12 x 1 x 2 + 12 x 0.75

.= 33.0 Ft^2

Problem-4 :-

Find area of Centering and Shuttering for Floor Column = ?

If size of Floor Column = 1' x 1' x 10'



Solution:

Note: area will be counted for wooden shuttering and as well as for tieing Floor Column steel. Height of Floor column shall be considered up to Ceiling height.

Centering and Shuttering area = Surface area of column

.= Peripheral Length x Depth

.= (L + B) x 2 x D

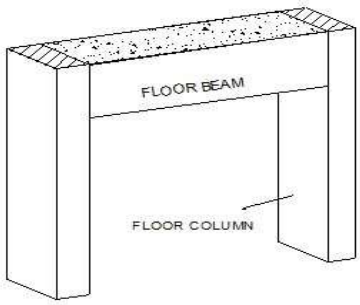
.= (1 + 1) x 2 x 10

.= 40.0 Ft^2

Problem-5:

Find area of Centering and Shuttering for Floor Beam = ?

If size of Floor beam = 12' x 0.75' x 1'



Solution:

Centering and Shuttering area = Side area + Bottom area

.= L x D x 2 + L x B

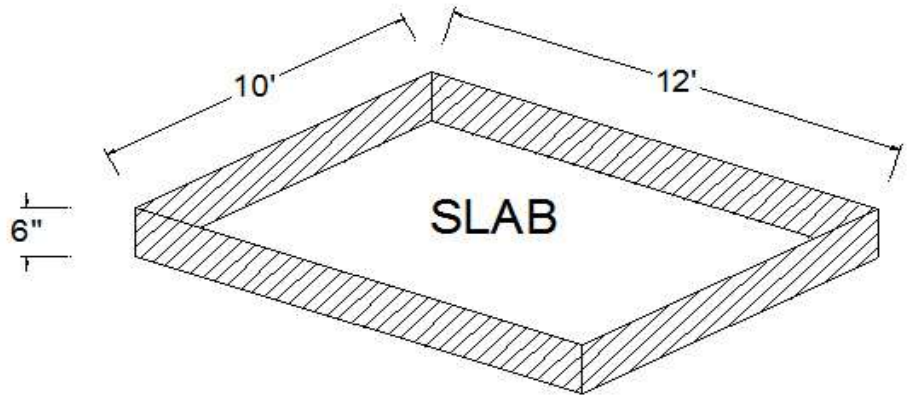
.= 12 x 1 x 2 + 12 x 0.75

.= 33.0 Ft^2

Problem-6:

Find area of Centering and Shuttering for the given Floor Slab = ?

If size of Floor Slab = 10' x 12' x 0.5'



Solution:

Centering and Shuttering area = Side area + Bottom area

.= Peripheral Length x Depth + Bottom area

.= (L + B) x 2 x D + L x B

.= (10 + 12) x 2 x 0.5 + 10 x 12

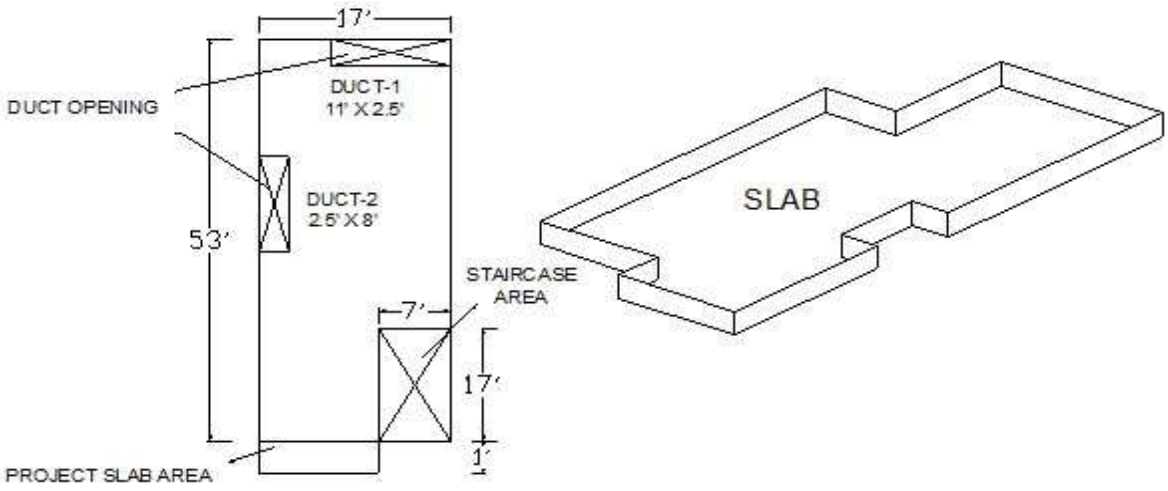
.= 142.0 Ft^2

Problem-7:

Find area of Centering and Shuttering for the given Floor Slab = ?

If size of Floor Slab = 17' x 53' x 0.5' ; size of stair case = 7' x 17'

size of Duct-1 = 11' x 2.5' ; size of Duct-2 = 2.5' x 8'



Solution:

Centering and Shuttering area = Side area + Bottom area

.= Peripheral Length x Depth + Bottom area

.= 147.0 x 0.5 + 744.50

.= 818.0 Ft^2

(I). Peripheral length of slab = 17 + 53 + 17 + 1 x 2 + 53 + 2.5 x 2 = 147.0 Ft.

Thickness of slab = 6" = 0.5'

Bottom area of Slab = 17 x 53 + 1 x 10 (projected slab area) = 911.0 Ft^2

Deduction of openings:- Duct-1 = 11.0 x 2.5 = -27.50 Ft^2

Duct-2 = 2.5 x 8.0 = -20.0 Ft^2

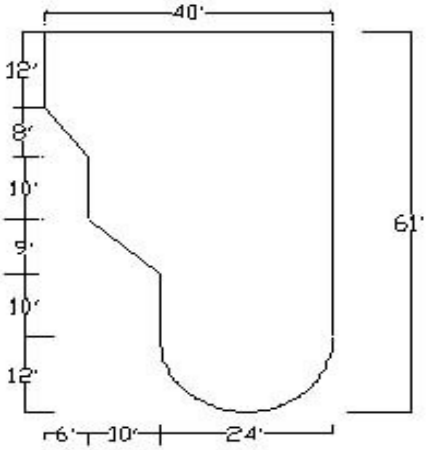
Staircase area = 7 x 17 = -119.0 Ft^2

Total bottom area of slab after deduction = 744.50 Ft^2

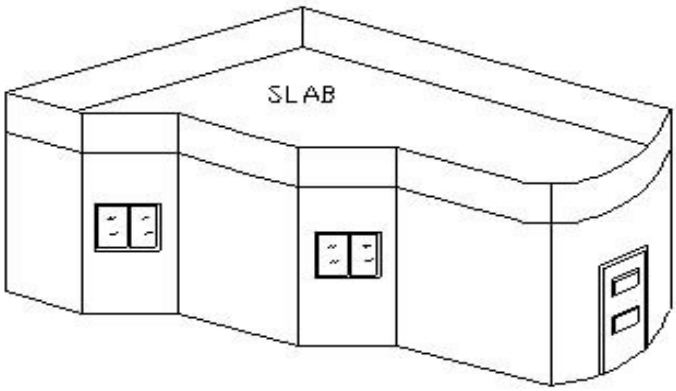
Problem-8:

Find area of Centering and Shuttering for Floor Slab = ?

if thickness of slab = 6" = 0.5'



PLAN OF SLAB



Solution:

Centering and Shuttering area = Side area + Bottom area

.= Peripheral Length x Depth + Bottom area

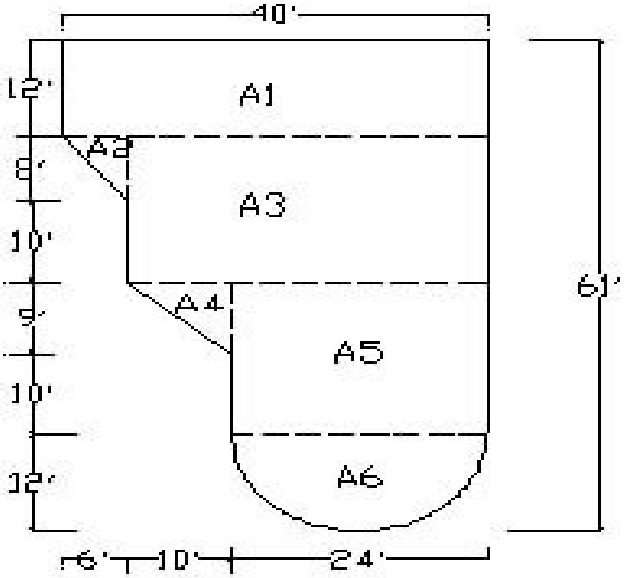
.= 182.152 x 0.5 + 1843.194

.= 1934.27 Ft^2

(I). Peripheral length of slab = .= 40 + 49 + 2 x π x 12 x 0.50 + 10 + 13.453 + 10 + 10 + 12

.= 182.152 Ft

Thickness of slab = 6" = 0.5'



PLAN OF SLAB

Using Pythagoras theorem to find inclined length

$c = V(a^2 + b^2)$

$c = V(10^2 + 9^2) = 13.453$ Ft

$c = V(6^2 + 8^2) = 10.0$ Ft

Bottom Area of Slab can be found out by using thumb rule i.e. dividing area in to parts

Area-1 = A1 = area of rectangle = L x B = 40 x 12 = 480.0 Ft^2

Area-2 = A2 = area of triangle = 0.5 x L x B = 0.5 x 8 x 6 = 24.0 Ft^2

Area-3 = A3 = area of rectangle = L x B = 34 x 18 = 612.0 Ft^2

Area-4 = A4 = area of triangle = 0.5 x L x B = 0.5 x 9 x 10 = 45.0 Ft^2

Area-5 = A5 = area of rectangle = L x B = 24 x 19 = 456.0 Ft^2

Area-6 = A6 = area of semi-circle = $\pi/4 \times d^2 \times 0.50 = \pi/4 \times 24^2 \times 0.50 = 226.194$ Ft^2

Total Bottom area of Slab = A1 + A2 + A3 + A4 + A5 + A6 = 1843.194 Ft^2

Problem-9:

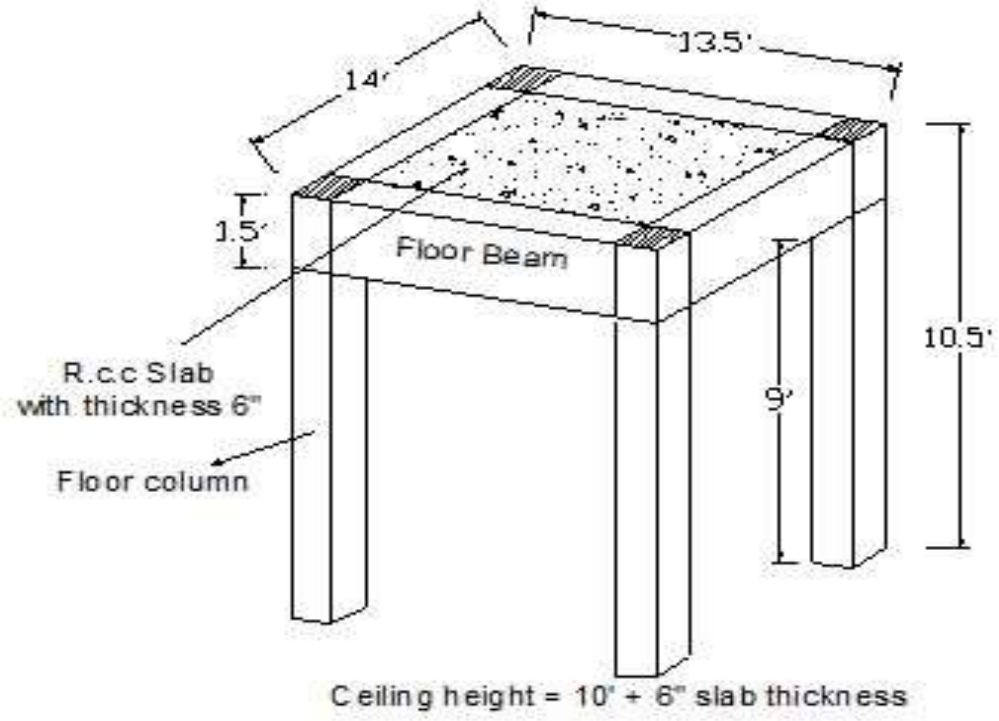
Find Area of Centering and Shuttering for Floor Column, Floor Beam and Floor Slab = ?

if size of column = 12" x 9"

Height of Ceiling = 10' and Slab thickness = 6" = 0.5'

Size of beam along horizontal axis = 12' x 9" x 1'

Size of beam along vertical axis = 12' x 9" x 1'



Solution:

size of slab =

L = 13.5' - 9" -9" = 12'

B = 14' - 1' - 1' = 12'

D = 6" = 0.5'

therefore beam lengths =

L = 13.5' - 9" - 9" = 12'

L = 14' - 1' - 1' = 12'

1. Floor Column:

Centering and Shuttering area = Peripheral length x Depth x no. of Columns

.= (L + B) x 2 x D x no.s

.= (1 + 0.75) x 2 x 10 x 4

.= 140.0 Ft^2

Note: while doing shuttering calculation for floor column, height of floor column shall be considered up to ceiling height only. (i.e., given ceiling height = 10')

2. Floor Beam along horizontal axis :

Centering and Shuttering area = (Side area of beam + bottom area of beam)x no. of beams

L= 13.5'-9"-9"

L= 12'

.= (L x D x 2 + L x B) x no. of beams

.= (12 x 1 x 2 + 12 x 0.75) x 2 = 66.0 Ft^2

3. Floor Beam along vertical axis :

Centering and Shuttering area = (Side area of beam + bottom area of beam)x no. of beams

L= 14'-1'-1'

L= 12'

.= (L x D x 2 + L x B) x no. of beams

.= (12 x 1 x 2 + 12 x 0.75) x 2 .= 66.0 Ft^2

4. Floor Slab :

Centering and Shuttering area = Side area of Slab + Bottom area of Slab

.= Peripheral length x Depth + Bottom area of Slab

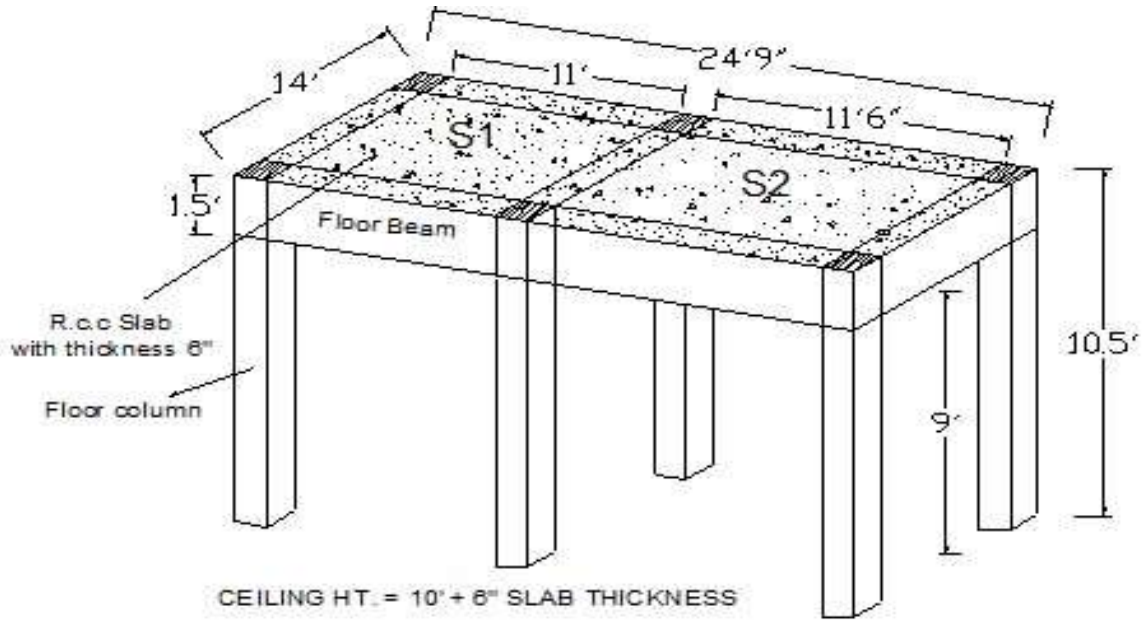
.= (L + B) x 2 x D + L x B

.= (13.5 + 14) x 2 x 0.5 + 13.5 x 14

.= 216.50 Ft^2

Problem-10 :

Find Area of Centering and Shuttering for Floor Column, Floor Beam and Floor Slab = ?



If size of column = 12" x 9"

Height of Ceiling = 10' and Slab thickness = 6" = 0.5'

Breadth of beam = 9" ; Depth of Beam = 12"

Solution:

1. Floor Column:

Centering and Shuttering area = Peripheral length x Depth x no. of Columns

.= (L + B) x 2 x D x no.s

.= (1 + 0.75) x 2 x 10 x 6

.= 210.0 Ft^2

Note: while doing shuttering calculation for floor column, height of floor column shall be considered up to ceiling height only. (i.e., given ceiling height = 10')

2. Floor Beam along horizontal axis :

Centering and Shuttering area = (Side area of beam + bottom area of beam)x no. of beams

L= 11' + 11.5'

L= 22.5'

.= (L x D x 2 + L x B) x no. of beams

.= (22.5 x 1 x 2 + 22.5 x 0.75) x 2 = 123.75 Ft^2

3. Floor Beam along vertical axis :

Centering and Shuttering area = (Side area of beam + bottom area of beam)x no. of beams

L= 14'-1'-1' .= (L x D x 2 + L x B) x no. of beams

L= 12' .= (12 x 1 x 2 + 12 x 0.75) x 3 = 99.0 Ft^2

4. Floor Slab :

Centering and Shuttering area = Side area of Slab + Bottom area of Slab

.= Peripheral length x Depth + Bottom area of Slab

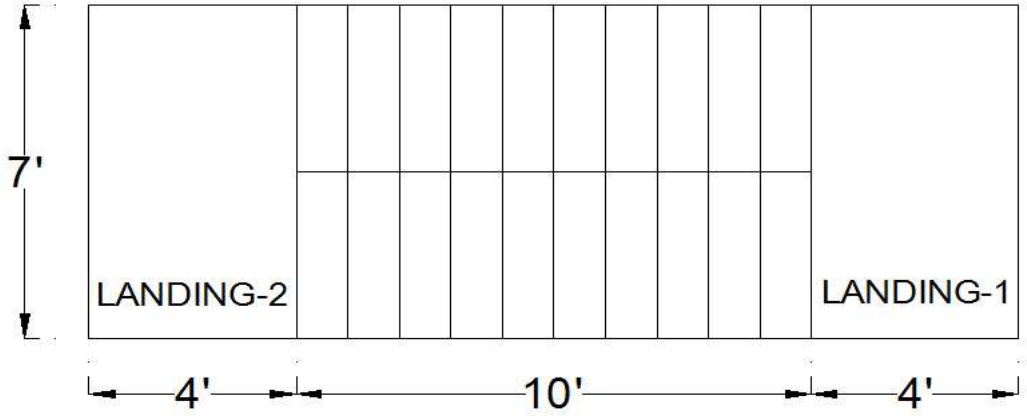
.= (L + B) x 2 x D + L x B

.= (24.75 + 14.0) x 2 x 0.5 + 24.75 x 14.0

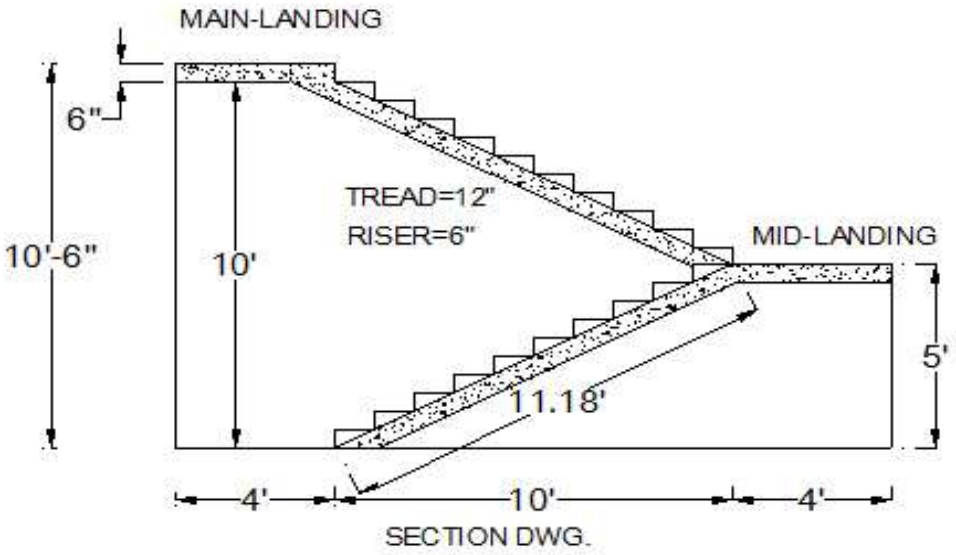
.= 385.25 Ft^2

Problem-11 :

Find Area of Centering and Shuttering for Stair-case = ?



PLAN OF DOG-LEG STAIRCASE



SECTION DWG.

Solution :

1. Waist Slab : S1 & S2

Centering and Shuttering area = (Side area of Slab + Bottom area of Slab) x no. of slabs

By Pythagoras theorem .= (L x D x 2 + L x B) x no. of slabs

$c = V(a^2 + b^2)$.= (11.18 x 0.5 x 2 + 11.18 x 3.5) x 2

$c = V(10^2 + 5^2)$.= 100.62 Ft^2

C = 11.18 Ft. (Inclined length)

2. Steps :

Centering and Shuttering area = (Side area of Step + Front area of Step) x no. of Steps

.= (0.5 x B x H x 2 + L x D) x no. of Steps

.= (0.5 x 1 x 0.5 x 2 + 3.5 x 0.5) x 20

.= 45.0 Ft^2

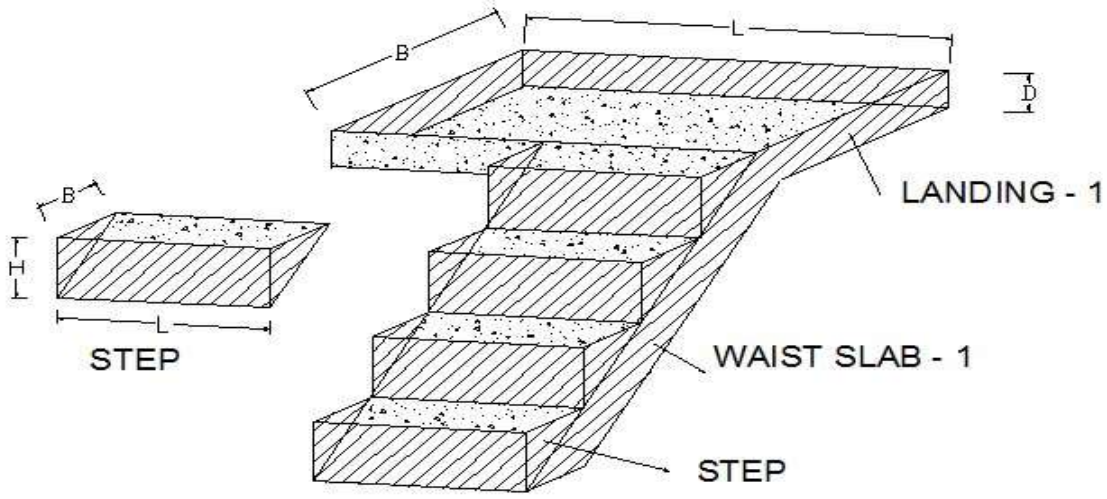
3. Landings : L1 & L2

Centering and Shuttering area =(three Side area of Landing + Bottom area of Landing) x no. of Landings

.= (B x D x 2 + L x D + L x B) x no. of Landings

.= (4 x 0.5 x 2 + 7 x 0.5 + 7 x 4) x 2

.= 71.0 Ft^2



VOLUME OF CONCRETE CALCULATION

Definition :- Capacity of anything is called as Volume, the unit is Ft^3 or m^3.

Volume = Area x Depth

Problem-1 :- Find Volume of Concrete for a given figure

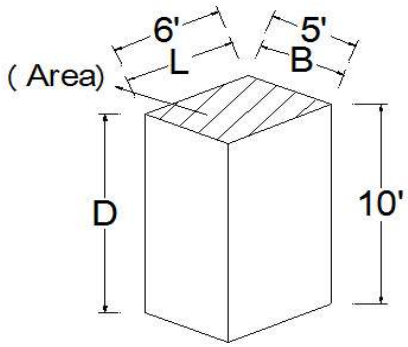
Solution :-

Volume = Area x Depth

.= L x B x D

.= 6' x 5' x 10'

.= 300 Ft^3



Problem-2 :- Find Volume of Concrete for a given figure

Solution :-

Dividing top area in to two parts to find Area

Area-1 = 1.5' x 0.75' = 1.125 Ft^2

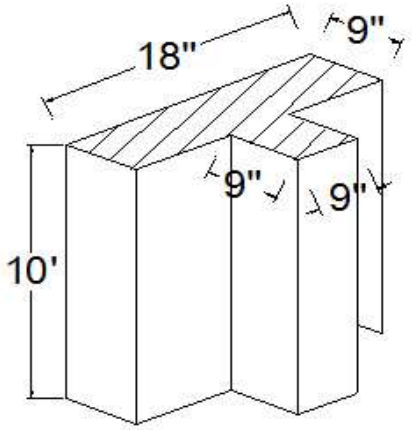
Area-2 = 0.75' x 0.75' = 0.5625 Ft^2

Total Area = 1.6875 Ft^2

Volume = Area x Depth

.= 1.6875 x 10'

.= 16.875 Ft^3



Problem-3 :- Find Volume of Concrete for a given figure

Solution :-

Dividing c/s area in to two parts to find Area

Area-1 = 3' x 0.5' = 1.5 Ft^2

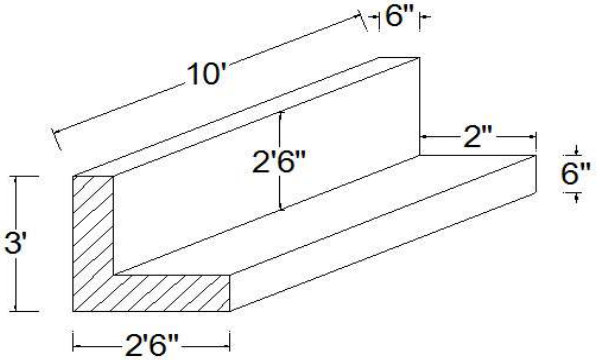
Area-2 = 2' x 0.5' = 1.0 Ft^2

Total Area = 2.50 Ft^2

Volume = C/S Area x Length

.= 2.50 x 10'

.= 25.0 Ft^3



Problem-4 :- Find Volume of Concrete for a given figure

Solution :-

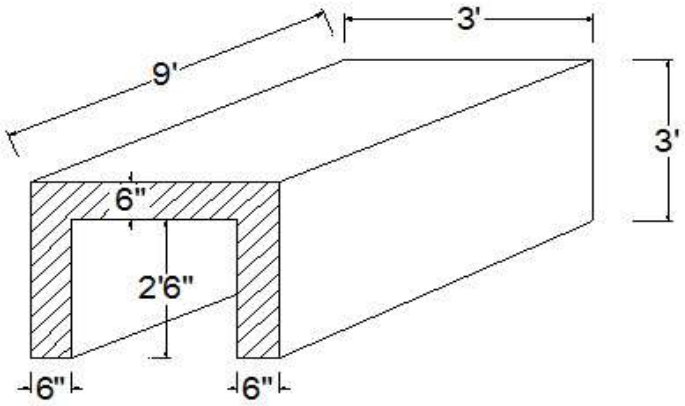
Dividing c/s area in to three parts to find Area

Area-1 = 3' x 0.5' = 1.5 Ft^2

Area-2 = 2.5' x 0.5' = 1.25 Ft^2

Area-3 = 2.5' x 0.5' = 1.25 Ft^2

Total Area = 4.0 Ft^2



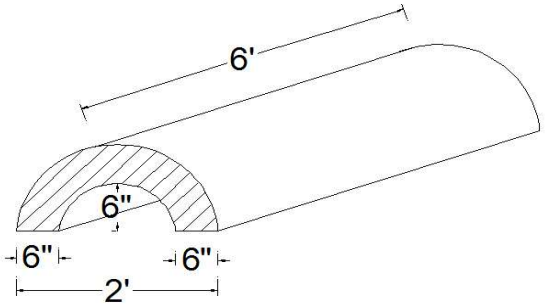
Volume = C/S Area x Length

.= 4.0 x 9'

.= 36.0 Ft^3

Problem-5 :- Find Volume of Concrete for a given figure

Solution :-



Arc Length = 2 x π x r x 0.5

Inner Arc Length = 2 x π x 0.5 x 0.5 = 1.57 Ft

Outer Arc Length = 2 x π x 1.0 x 0.5 = 3.141 Ft

Average Arc Length = (1.57 + 3.141)/2 = 2.355 Ft

Therefore, Length = 6' ; Breadth = 2.355' ; Depth = 0.5'

Volume = L x B x D = 6' x 2.355' x 0.5' = 7.065 Ft^3

Problem-6 :- Find Volume of Concrete for a given figure

Solution :-

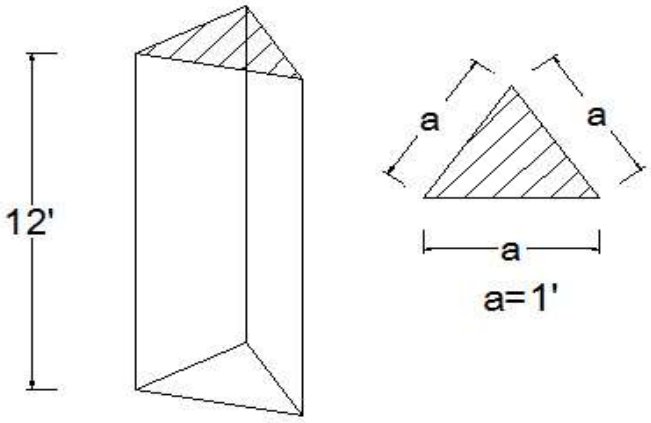
Area of Equilateral Triangle = $(a^2/4) \times \sqrt{3}$

Volume = Area x Depth

.= $(a^2/4) \times \sqrt{3} \times D$

.= $(1^2/4) \times \sqrt{3} \times 12$

.= 5.196 Ft^3



Problem-7 :- Find Volume of Concrete for a given figure

Solution :-

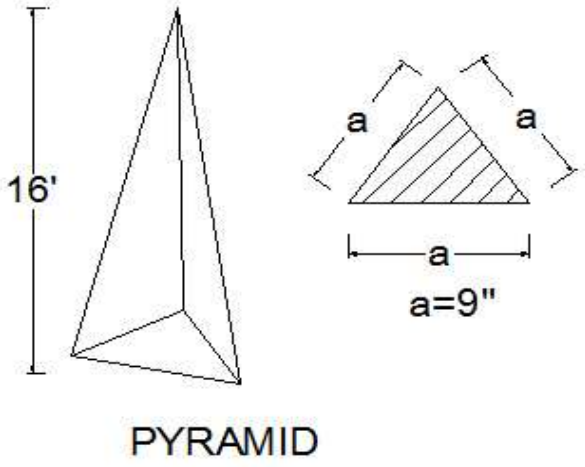
Area of Equilateral Triangle = $(a^2/4) \times \sqrt{3}$

Volume = (Area x Depth)/3

.= $((a^2/4) \times \sqrt{3} \times D) / 3$

.= $((0.75^2/4) \times \sqrt{3} \times 16) / 3$

.= 1.299 Ft^3



PYRAMID

Problem-8 :- Find Volume of Concrete for a given figure

Solution :-

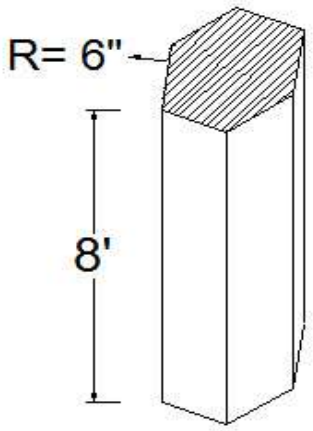
Area of Hexagon = (0.5 x R x 0.5 x R x TAN60) x 6

Volume = Area x Depth

.= (0.5 x 0.5' x 0.5 x 0.5' x TAN60) x 6 x D

.= (0.5 x 0.5' x 0.5 x 0.5' x TAN60) x 6 x 8'

.= 5.196 Ft^3



Problem-9 :- Find Volume of Concrete for a given figure

Solution :-

Area of Circle = $(\pi/4) \times d^2$

d1 = 2'

d2 = 4'

Average dia = (d1 + d2) / 2 = (2+4)/2 = 3'

Volume = Area x Depth

.= $(\pi/4) \times d^2 \times D$

.= $(\pi/4) \times 3^2 \times 6$

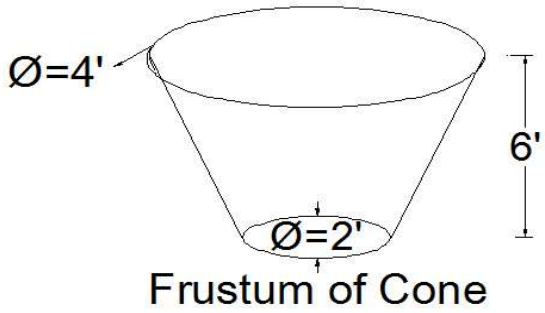
.= 42.411 Ft^3

or

Volume = $(\pi \times r^2 \times h)$

.= $(\pi \times 1.5^2 \times 6)$

.= 42.411 Ft^3

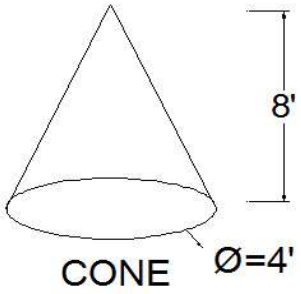


Frustum of Cone

Problem-10 :- Find Volume of Concrete for a given figure

Solution :-

Area of Circle = $(\pi/4) \times d^2$



Volume = (Area x Depth)/3

.= ($(\pi/4) \times d^2 \times D$)/3

.= $((\pi/4) \times 4^2 \times 8)/3$

.= 33.51 Ft^3

OR

Volume = $(\pi \times r^2 \times h)/3$

.= $(\pi \times 2^2 \times 8)/3$

.= 33.51 Ft^3

Problem-11 :- Find Volume of Concrete for a given figure

Solution :-

Length of R.C.C wall = (L + B) x 2

External length = (12' + 10') x 2 = 44 Ft

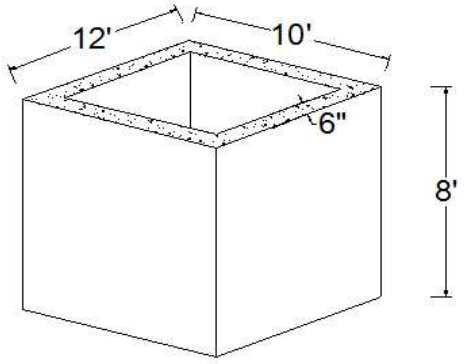
Internal length = (11'+9') x 2 = 40 Ft

Average length = (44 + 40)/2 = 42Ft

Volume = L x B x D

.= 42' x 0.5' x 8'

.= 168 Ft^3



RCC WALL

Problem-12 :- Find Volume of Concrete for a given figure

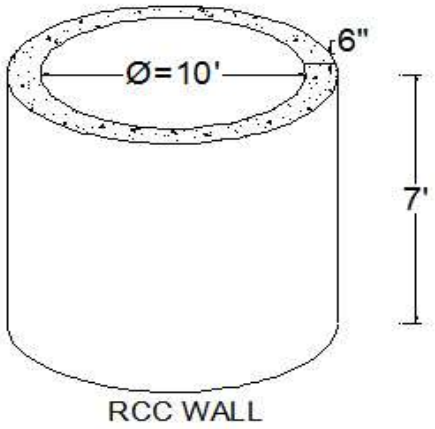
Solution :- length of Circle = 2 x π x r

Length of R.C.C wall = 2 x π x r

Internal length = 2 x π x 5 = 31.415Ft

External length = 2 x π x 5.5 = 34.557Ft

Average length = (31.415 + 34.557)/2 = 32.986Ft

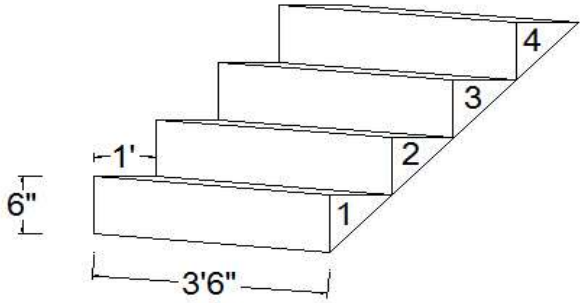


Volume = L x B x D

.= 32.986' x 0.5' x 7'

.= 115.451 Ft^3

Problem-13 :- Find Volume of Concrete for a given figure



Solution :-

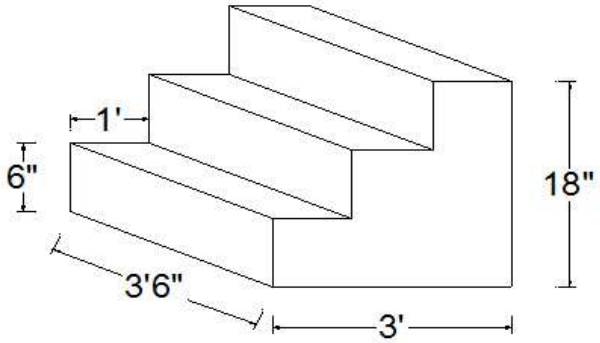
Volume = c/s area x length of step x No. of steps

.= 0.5 x B x H x L x No. of steps

.= 0.5 x 1' x 0.5' x 3.5' x 4

.= 3.50Ft^3

Problem-14 :- Find Volume of Concrete for a given figure



Solution :-

Dividing c/s area in to three parts to find Volume

Volume of Step = L x B x D

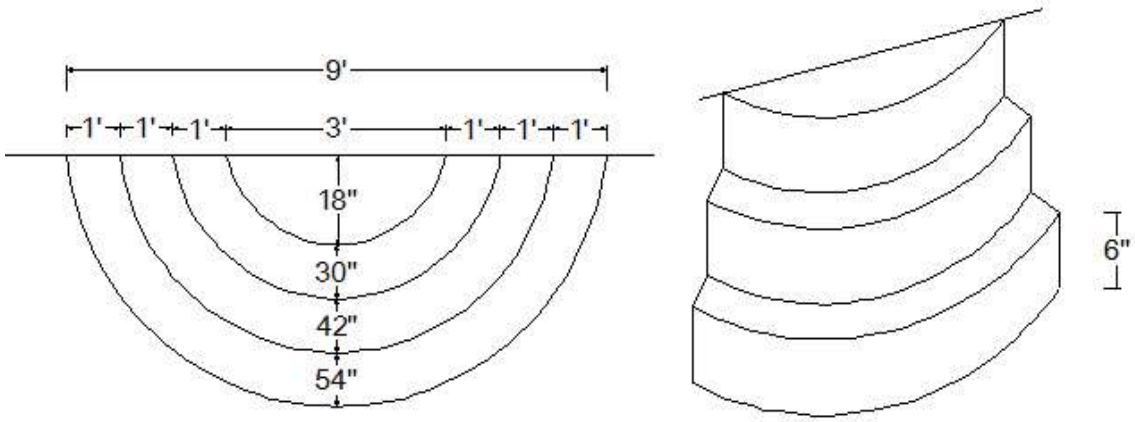
Volume of step-1 = 3.5' x 1' x 0.5' = 1.75 Ft^3

Volume of step-2 = 3.5' x 2' x 0.5' = 3.50 Ft^3

Volume of step-3 = 3.5' x 3' x 0.5' = 5.25 Ft^3

Total Volume = 10.50 Ft^3

Problem-15 :- Find Volume of Concrete for a given figure



Public Stair-case

Solution :-

Volume of Step = Top area x Depth x 0.5

.= $(\pi/4) \times d^2 \times D \times 0.5$

Volume of Step-1 .= $(\pi/4) \times 3'^2 \times 0.5' \times 0.5 = 1.767\ Ft^3$

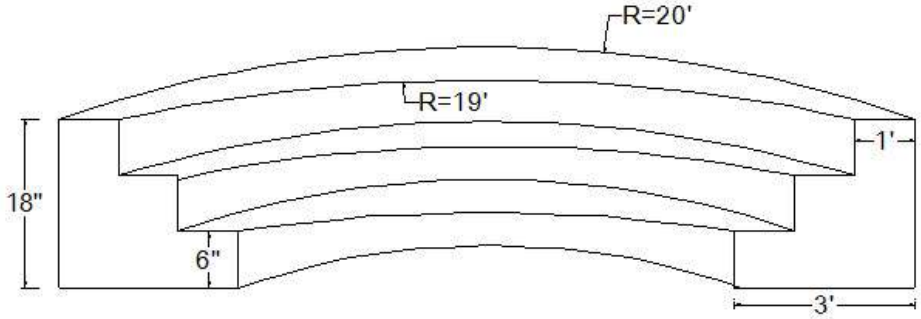
Volume of Step-2 .= $(\pi/4) \times 5'^2 \times 0.5' \times 0.5 = 4.908\ Ft^3$

Volume of Step-3 .= $(\pi/4) \times 7'^2 \times 0.5' \times 0.5 = 9.621\ Ft^3$

Volume of Step-4 .= $(\pi/4) \times 9'^2 \times 0.5' \times 0.5 = 15.904\ Ft^3$

Total volume = 32.20 Ft^3

Problem-16 :- Find Volume of Concrete for a given figure



STAIRCASE IN STADIUM

Solution :- Half-round stair-case

Arc Length of Step = 2 x π x r x 0.5

1. Arc Length of Step-1 = 2 x π x 19.5' x 0.5 = 61.261 Ft

For Step-1 External radius = 20'

For Step-1 Internal radius = 19' Average radius for Step-1 = (19' + 20')/2 = 19.5'

2. Arc Length of Step-2 = 2 x π x 19' x 0.5 = 59.69 Ft

For Step-2 External radius = 20'

For Step-2 Internal radius = 18' Average radius for Step-2 = (18' + 20')/2 = 19'

3. Arc Length of Step-3 = 2 x π x 18.5' x 0.5 = 58.119 Ft

For Step-3 External radius = 20' Average radius for Step-3 = (17' + 20')/2 = 18.5'

For Step-3 Internal radius = 17'

Volume .= L x B x D

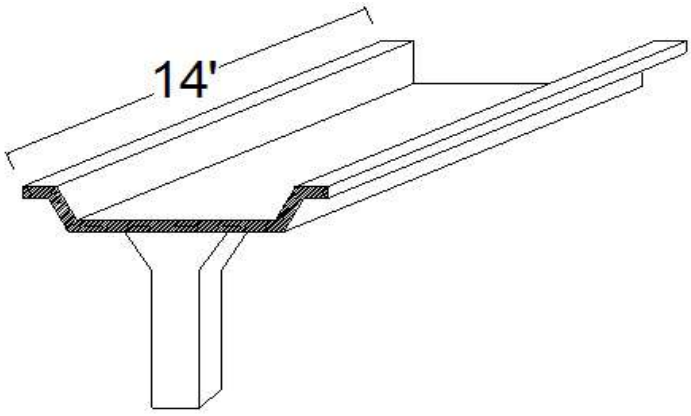
Step-1 = 61.261' x 1' x 0.5' = 30.630Ft^3

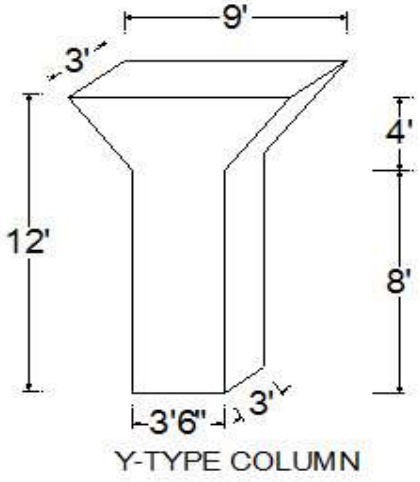
Step-2 = 59.690' x 2' x 0.5' = 59.69Ft^3

Step-3 = 58.119' x 3' x 0.5' = 87.178Ft^3

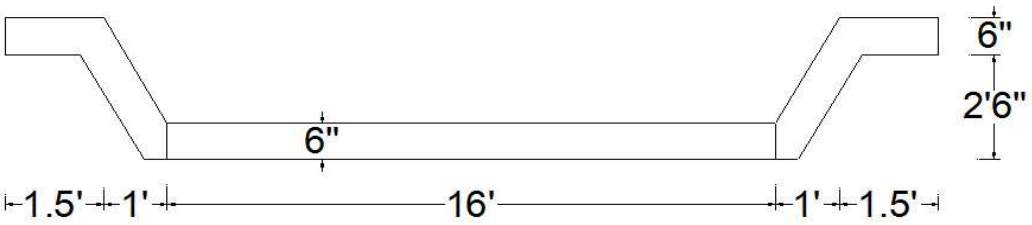
Total Volume = 177.498 Ft^3

Problem-17 :- Find Volume of Concrete for a given figure





Y-TYPE COLUMN



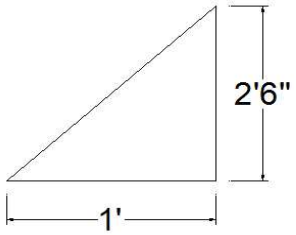
C/S OF SLAB

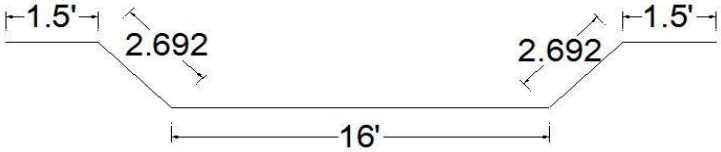
Solution :-

According to pythogorous theorem 'c' = $\sqrt{a^2 + b^2}$

.= 'c' = $\sqrt{1^2 + 2.5^2}$

.= 2.692Ft





Length = 1.5' x 2 + 2.692 x 2 + 16' = 24.384Ft

Breadth = 14'

Thickness = 0.5'

Volume = L x B x D

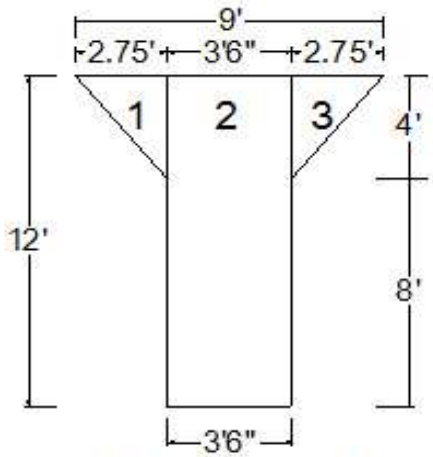
1. Volume of Concrete for Bridge panel = 24.384' x 14' x 0.5' = 170.688 Ft^3

2. Volume of Concrete for 'Y' Column = Front Area of y-column x thickness of y-Column

.= 53' x 3' = 159 Ft^3

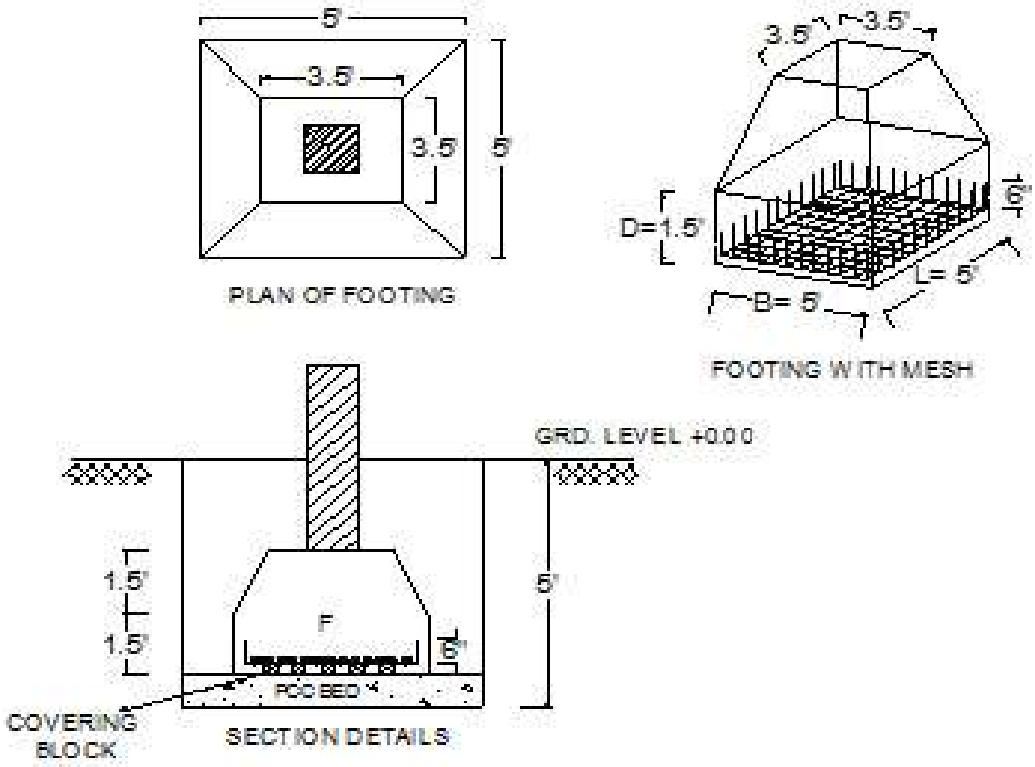
According to thumb rule dividing front area in to three parts

1. Area-1 = 0.5 x B x H = 0.5 x 2.75' x 4' = 5.5 Ft^2
2. Area-2 = L x B = 3.5' x 12' = 42 Ft^2
3. Area-3 = 0.5 x B x H = 0.5 x 2.75' x 4' = 5.5 Ft^2
4. Total Area = 53.0Ft^2



Y-TYPE COLUMN

Problem-18 :- Find Volume of Concrete for a given figure



Solution :- Dividing footing in to two parts

Part-1:-

L1 = 5' ; L2 = 3.5' Average length = (5'+3.5')/2 = 4.25'

B1 = 5' ; B2 = 3.5' Average Breadth = (5'+3.5')/2 = 4.25'

D = 1.5'

Part=2 :-

L = 5' ; B = 5' ; D = 1.5'

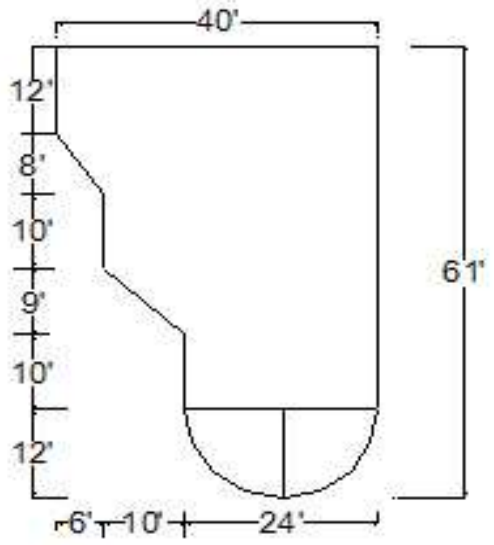
1. Volume of Concrete for part-1 = L x B x D = 4.25 x 4.25 x 1.5 = 27.093 Ft^3
2. Volume of Concrete for part-2 = L x B x D = 5' x 5' x 1.5' = 37.5 Ft^3

Total Volume = 64.593 Ft^3

Problem-19 :-

Find Volume of Concrete for a Slab in a given figure

if thickness of Slab = 6"



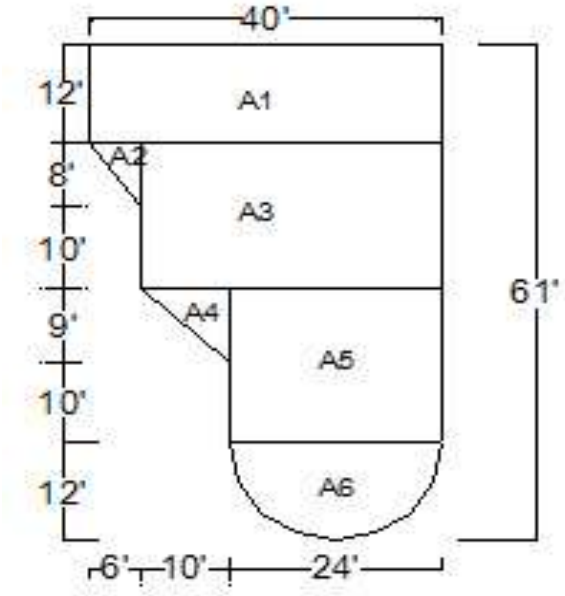
PLAN OF SLAB

Solution :-

Volume of Concrete required for slab = Area of slab x thickness of slab

.= 1843.194 x 0.5'

.= 921.597 Ft^3



PLAN OF SLAB

Area of Slab can be found out by using thumb rule i.e. dividing area in to parts

Area-1 = A1 = area of rectangle = L x B = 40 x 12 = 480.0 Ft^2

Area-2 = A2 = area of triangle = 0.5 x L x B = 0.5 x 8 x 6 = 24.0 Ft^2

Area-3 = A3 = area of rectangle = L x B = 34 x 18 = 612.0 Ft^2

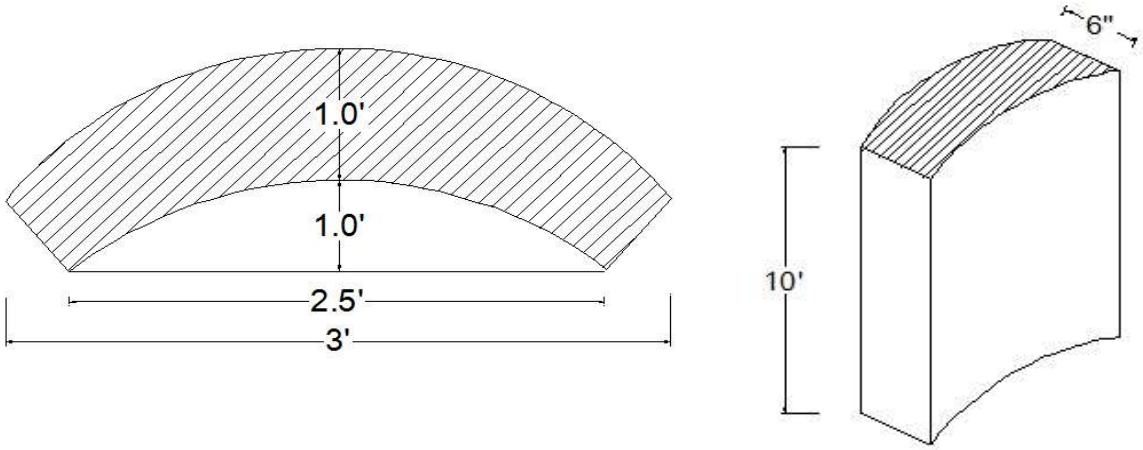
Area-4 = A4 = area of triangle = 0.5 x L x B = 0.5 x 9 x 10 = 45.0 Ft^2

Area-5 = A5 = area of rectangle = L x B = 24 x 19 = 456.0 Ft^2

Area-6 = A6 = area of semi-circle = $\pi/4 \times d^2 \times 0.50 = \pi/4 \times 24^2 \times 0.50 = 226.194\ Ft^2$

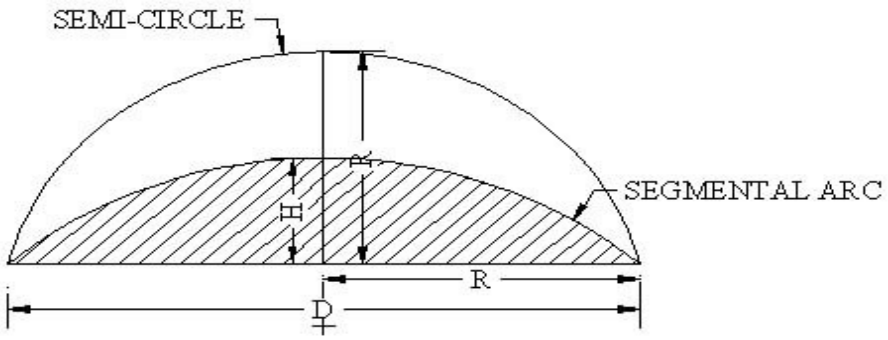
Total area of Slab = A1 + A2 + A3 + A4 + A5 + A6 = 1843.194 Ft^2

Problem-20 :- Find Volume of Concrete from the given Arch type column



Solution: -

Segmental Arc formula :-



(i) Area = A = $(2/3 \times D \times H) + (H^3/2D)$

where d = diameter of circle

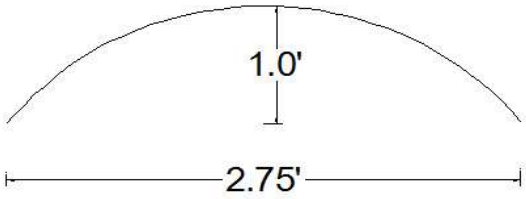
H = height of arc

(ii) Arc Length = L = (8b - 2r)/3

where r = radius of circle

$b = V(r^2 + h^2)$

Given : D = 2.75' ; R = 1.375' ; H = 1.0'



Segmental arc length = (8B-2R)/3

where 'B' = V (r^2 + h^2)

.= V (1.375^2 + 1^2)

.= 1.70

Avg. 'D' = (3+2.5)/2 = 2.75'

R = 1.375'

Segmental arc length = (8 x 1.7 - 2 x 1.375)/3

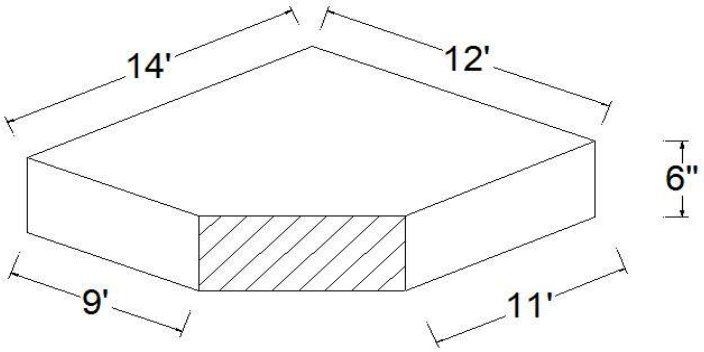
.= 3.616'

Volume of Concrete required for Arch Type column = L x B x D

Where L = 3.616 ; B = 0.5' ; D = 10'

Volume = 3.616' x 0.50' x 10' = 18.08 Ft^3

Problem-21 :- Find Volume of Concrete from the given Figure



Solution :-

Top Area :-

Area-1 = L X B = 14' x 9' = 126.0 Ft^2

Area-2 = L x B = 11' x 3' = 33.0Ft^2

Area-3 = 0.5 x B x H = 0.5 x 3' x 3' = 4.50Ft^2

Total Area = 163.50Ft^2

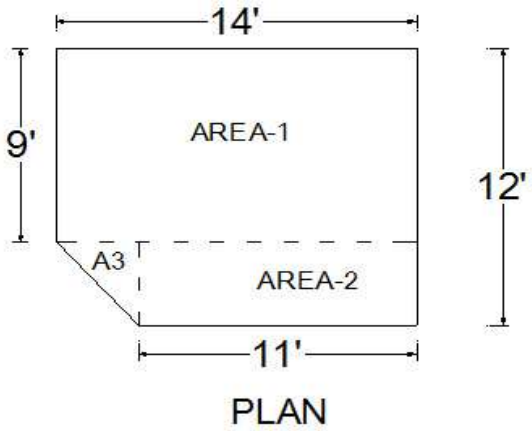
Thickness = 6" = 0.50'

Volume = Top area x Depth

.= 163.50 x 0.50

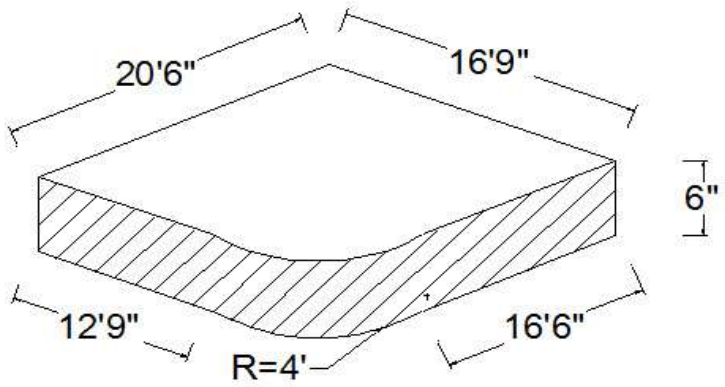
.= 81.75Ft^3

Dividing Top area in to three parts



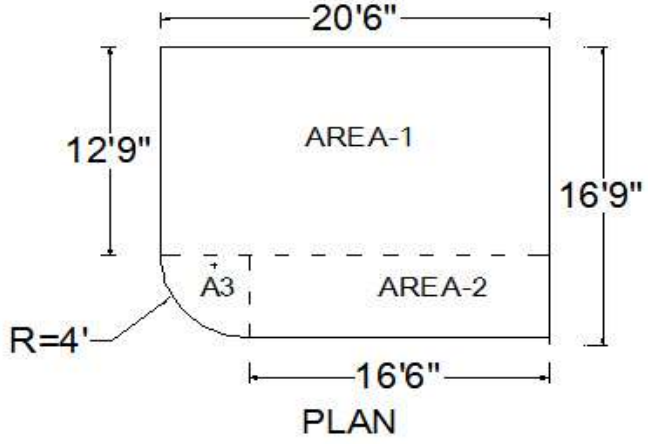
PLAN

Problem-22 :- Find Volume of Concrete from the given Figure



Solution :-

Dividing Top Area in to parts :-



Area-1 = L X B = 20.5' x 12.75' = 261.375 Ft^2

Area-2 = L x B = 16.5' x 4' = 66.0Ft^2

Area-3 = $(\pi/4) \times d^2 \times 0.25$

.= $(\pi/4) \times 8^2 \times 0.25 = 12.566\ Ft^2$

Total Area = 339.941 Ft^2

Thickness = 6" = 0.50'

Volume = Top area x Depth

.= 339.941 x 0.50

.= 169.97 Ft^3

CAPACITY OF WATER IN SUMP CALCULATIONS

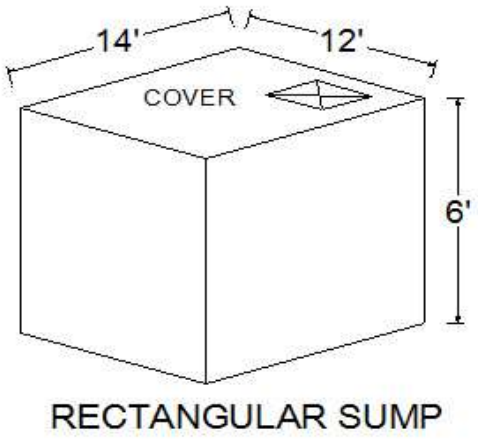
Problem-1:-

Find capacity of Rectangular Sump (water tank below ground level)
if size of Sump = 14' x 12' x 6' and no. of water tanker required
to fill the sump if, each water tanker has capacity to carry 5000 litres.

Solution:-

1. Capacity of water tank:-

Standard Specification : 1.0Ft^3 = 28.34 Litres



RECTANGULAR SUMP

Volume of Rectangular Sump = L x B x D
.= 14' x 12' x 6'
.= 1008 Ft^3

for 1.0 Ft^3 = 28.34 Litres
1008 Ft^3 = ? Litres
.= 1008 x 28.34
Total capacity .= 28,566.72 Litres

2. No. of water tank required to fill the Sump:-

no. of water tanker required = capacity of water in Sump / capacity of each water tanker
.= 28566.72 / 5000
.= 5.71 or approximately equal to 6 water tanker required.

Problem-2:-

Find (i). capacity of Circular Sump (water tank below ground level)
if Dia of Sump = 12' and Depth of Sump = 6'
(ii). no. of water tanker required to fill the sump if,
each water tanker has capacity to carry 5000 litres.

Solution:-

1. Capacity of water tank:-

Standard Specification : 1.0Ft^3 = 28.34 Litres

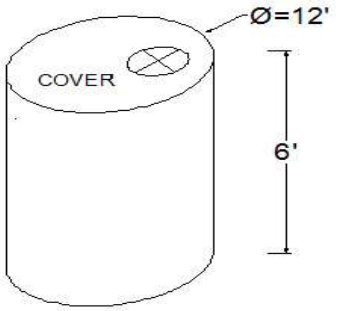
Volume of Circular Sump = Top area x Depth
.= $(\pi/4) \times d^2 \times D$
.= $(\pi/4) \times 12^2 \times 6$
.= 678.584 Ft^3

for 1.0 Ft^3 = 28.34 Litres

678.584 Ft^3 = ? Litres

.= 678.584 x 28.34

Total capacity .= 19,231.07 Litres



CIRCULAR SUMP

2. No. of water tank required to fill the Sump:-

No. of water tanker required = capacity of water in Sump / capacity of each water tanker

.= 19,231.07 / 5000

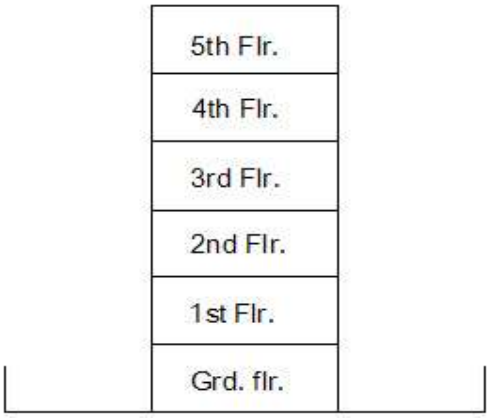
.=3.846 or approximately equal to 4 water tanker required

Problem-3:-

For a building of G+5 (Ground Floor + 5 Floor) with built-up area 30,000 Ft^2,
Design required Size of Rectangular Sump or Circular Sump, so that the
water stored in sump should be sufficient for the occupant who lives in building.

Solution:-

1. Total Built-up area = 30,000 Ft^2
2. No. of Floors = 6



SECTION DWG. OF BUILDING

3. Area of each Floor = Total built-up area for G+5 floor / no. of floors

.= 30,000 / 6

.= 5000 Ft^2

4. Area of each flat = 1000 Ft^2

2BHK = Two bed room, Hall and kitchen, is generally
built-up on an area of 100yd^2 = 900Ft^2
with an additional area = 100 Ft^2 common area
Total area of 2BHK = 900 + 100 = 1000 Ft^2
common area includes, Stair-case area + Lift area + Corridor area

4. No. of Flats on each Floor = Area of each floor / area of each Flat
.= 5000/ 1000
.= 5 Flats on each Floor

5. Total Flats in building = No. of Floors x No. of Flats on each Floor
.= 5 x 5
.= 25 Flats in building

Note:-
Ground Floor will be used for Car-parking and Occupant will start living from 1st Floor

6. No. of Occupant live in each Flat = 8 (common practice)
(Father, Mother, four children and their grand Father and grand Mother)

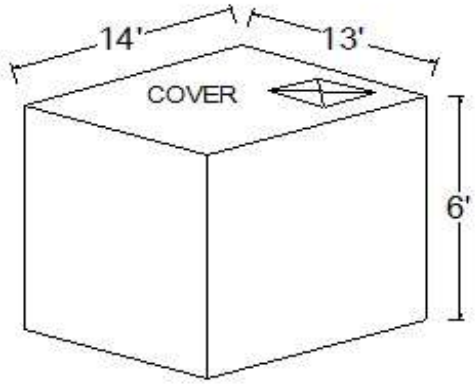
7. Total no. of Occupants live in building = no. of Occupant x no. of Flats
.= 8 x 25
.= 200 people

8. Usage of water by each Human being / day = 100 litres
other utensils (kitchen, laundry room, etc) = 50 liters
Total = 150 litres

9. Water required for the building = usage of water by each Human being / day x no. of Occupants
.= 150 x 200
.= 30,000 Litres

10. Capacity of water for 1.0 Ft^3 = 28.34 litres

28.34 litres = 1.0 Ft^3
30,000 litres = ? Ft^3
.= (30,000 / 28.34) x 1
.= 1058.57 Ft^3



RECTANGULAR SUMP

Case-I :- If Rectangular Sump to be designed then required dimension of Sump,

Required Size of Rectangular Sump = 14' x 13 ' x 6'

Volume = L x B x D

.= 14' x 13' x 6' = 1092 Ft^3

there should be some surplus water

Case-II :- If Circular Sump to be designed then required dimension of Sump,

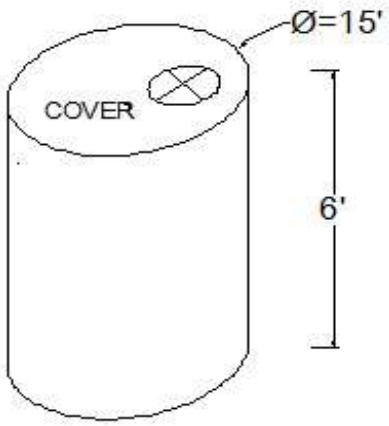
Required Size of Circular Sump: Dia = 15' : Depth = 6'

Volume = $(\pi/4) \times d^2 \times D$

.= $(\pi/4) \times 15^2 \times 6$

.= 1060.28 Ft^3

there should be some surplus water



CIRCULAR SUMP

FINISH WORK CALCULATION

Most commonly used brick in India, is Indian red brick

size of each Indian red brick = 9" x 4" x 3"

size of each over-seas brick = 0.40m x 0.20m x 0.20m

C : M required for 1.0m^3 of Brick Work					
S.no.	Ratio or	Sand	Cement	Cement	Cement
	Dry proportion	in m^3	in kgs	in bags	in m^3
1	1:06	0.20	48.00	0.96	0.033
2	1:05	0.20	57.60	1.152	0.04
3	1:04	0.20	72.00	1.44	0.05
4	1:03	0.20	96.00	1.92	0.066

For 1.0m^3 of Brick work quantity of sand and cement:-

(i). Sand = 1.0m^3 = 0.20 m^3 Constant

(ii). Cement = 1.0m^3 = (0.20 x 1440) / last digit of ratio

C:M required for 1.0m^3 of brick work with ratio 1:6

(i). Sand = for 1.0m^3 = 0.20m^3 constant

(ii) Cement in kgs = for 1.0m^3 = (0.20 x 1440) / 6

.= 48.0 kgs

(a). each bag of cement = 50.0 kgs

No. of bags required = 48.0 / 50.0

.= 0.96 bag

(b). cement in m^3 : -

weight of cement/m^3 = 1440kgs

1440 kgs = 1.0m^3

48kgs = ? M^3

48 / 1440 = 0.333m^3

BRICK WORK CALCULATIONS

Note:-

Volume of Cement : Mortar shall be deducted from Volume of Brick work because there will be lot of wastage while executing brick work.

if you still want to deduct the volume of C:M from volume of brick work then, the quantity of c:m shall be deducted as **20 %** of brick work.

Brick work calculation can be done by means of Volume of wall or Area of wall.

Problem-1 (with volume) :-

For an area 1200 Ft^2 of brick work find no. of bricks and cement : mortar required with ratio 1 : 6 , if size of brick = 9" x 4" x 3" ; wall thickness = 4" ; Height of Ceiling = 10'

Solution :-

(i). Volume of Brick work = Area of wall x thickness of wall

.= 1200 x 0.333

.= 399.6 Ft^3

4" = ? Ft

since 1' = 12"

4/12 =0.333Ft

(Ii). Volume of each Brick = L x B x D

.= 9" x 4" x 3"

.= 108"^{3}

.= 0.0625 Ft^3

108"^{3} = ? Ft^3

since 1' = 12"

.=108/ 12^3

.= 0.0625 Ft^3

(iii). No. of Bricks required = Volume of brick work required / Volume of each brick

.= 399.6 / 0.0625

.= 6393.6 bricks

.= or approximately equal to 6394 bricks

(iv). C:M required for brick work with ratio 1:6

Volume of brick work = 399.6 Ft^3

.= 11.324 m^3

399.6 Ft^3 = ? m^3

since 1.0m = 3.28 Ft

.= 399.6/ 3.28^3

.= 11.324 m^3

(a). Sand = for 1.0m^3 = 0.20 m^3

11.324 m^3 = ?

.= 11.324 x 0.20

.= 2.264 m^3

(b). Cement = For 1.0m^3 = (0.20 x 1440) / last digit of ratio
.= (0.20 x 1440) / 6
.= 48.0 kgs

for 1.0m^3 = 48.0 kgs
11.324 m^3 = ?
.= 11.324 x 48
.= 543.552 kgs

each bag of cement = 50.0 kgs
No. of bags = 543.552 / 50.0
.= 10.87 bags
.= or approximately equal to 11 bags

Problem-2 (with Area) :-

For an area 2000 Ft^2 of brick work find no. of bricks and cement : mortar required with ratio 1: 5 , if size of brick = 9" x 4" x 3" ; wall thickness = 4" ;
Height of Ceiling = 10'

Solution :-

(i). Area of Brick work = 2000 Ft^2

$27"^2$ = ? Ft^2
since 1' = 12"
$27/12^2$ = 0.1875 Ft^2

(ii). Area of each brick = 9" x 3"
.= 27 $"^2$
.= 0.1875 Ft^2

(iii). No. of bricks required = Area of brick work / Area of each brick
.= 2000 / 0.1875
.= 10666.66 bricks
.= or approximately equal to 10667 bricks

(iv). C:M required for brick work with ratio 1:5

Volume of brick work = Area of brick work x wall thickness
.= 2000 x 0.333
.= 666 Ft^3
.= 18.873 m^3

666 Ft^3 = ? m^3
since 1.0m = 3.28 Ft
.= 666 / 3.28^3
.= 18.873 m^3

(a). Sand = for 1.0m^3 = 0.20 m^3
18.873 m^3 = ?
.= 18.873 x 0.20
.= 3.774 m^3

(b). Cement = For 1.0m^3 = (0.20 x 1440) / last digit of ratio

.= (0.20 x 1440) / 5

.= 57.6 kgs

for 1.0m^3 = 57.6 kgs

18.873 m^3 = ?

.= 18.873 x 57.6

.= 1087.084 kgs

each bag of cement = 50.0 kgs

No. of bags = 1087.084 / 50.0

.= 21.741 bags

.= or approximately equal to 22 bags

Problem - 3 :-

Find (i) No. of bricks required to construct this room

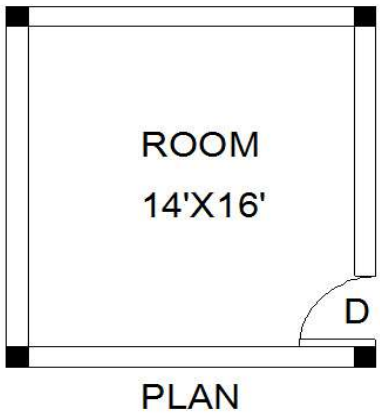
(ii). C:M required for brick work with ratio 1:6,

if size of brick is 9" x 4" x 3" and Height of Ceiling is 10'

size of door = 3' 6" x 7'

size of column = 1' x 1'

thickness of wall = 8"



PLAN

Solution:-

Length of four walls after deduction of length of column = 14' x 2 + 16' x 2 = 60 Ft.

(I). Volume of Brick work = L x B x D

.= 60' x 0.666' x 10'

.= 399.6 Ft^3

8" = ? Ft

since 1' = 12"

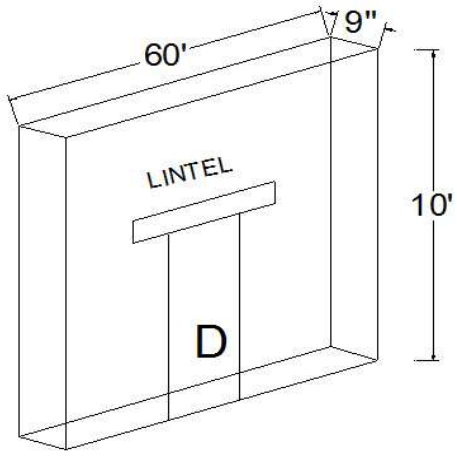
8/12 = 0.666Ft

(ii). Deductions of openings:-

(a). Door Deduction :-

Vol. of Door = L x B x D

.= 3.5' x 0.666' x 7' = 16.317 Ft^3



(b). Lintel Deduction :-

Length of Lintel = 3.5' + 0.333' + 0.333'

.= 4.166 Ft

Note:-

Provide 4" bearings on each side of

Doors and Windows for each lintel.

Height of lintel = 4" = 0.333 Ft

Vol. of Lintel .= L x B x D
.= 4.166 x 0.666' x 0.333'
.= 0.923 Ft^3

4" = ? Ft
since 1' = 12"
4/12 = 0.333Ft

(iii). Total volume of brick work = 399.6 Ft^3 - 16.317 Ft^3 - 0.923 Ft^3 = 382.36 Ft^3

(iv). Vol. of each Brick = L x B x D
.= 9" x 4" x 3"
.= 108"^{3}

108"^{3} = ? Ft^3
since 1' = 12"
.=108/ 12^3
.= 0.0625 Ft^3

(v). No. of Bricks required = Volume of Brick work / Volume of each Brick
.= 382.36 / 0.0625
.= 6117.76 bricks
.= approximately equal to 6118 bricks

(vi). C:M required for Brick work with ratio 1:6

(a). Sand = 1.0 M^3 = 0.20 M^3
10.835 m^3 = ?
.= 10835 x 0.20
.= 2.167 m^3

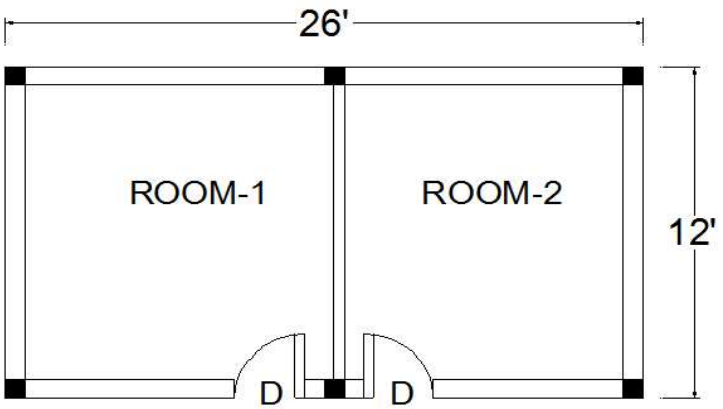
volume of brick work = 382.36 Ft^3
382.36 Ft^3 = ? M^3
since 1.0 m = 3.28 Ft
.= 382.36 / 3.28^3
.= 10.835 m^3

Sand in terms of weight :-
weight of sand / m^3 = 1.75 tons
1.0m^3 = 1.75 tons
2.167m^3 = ?
1.75 x 2.167 = 3.792 tons **(Sand in terms of weight)**

(b). Cement required for brick work :-
1.0m^3 = (0.20 x 1440) / last digit of ratio
.= (0.20 x 1440) / 6
.= 48.0 kgs

1.0m^3 = 48 kgs
10.835 m^3 = ?
.= 10.835 x 48
.= 520.08kgs
Each bag of cement = 50kgs
no. of bags required = 520.08 / 50
.= 10.40 bags
.= approximately equal to 11 bags

Problem - 4 :-



PLAN

Find (i) No. of bricks required to construct these rooms
(ii). C:M required for brick work with ratio 1:6,
if size of brick is 9" x 4" x 3" and Height of Ceiling is 10'
size of door = 3' 6" x 7'
size of column = 1' x 1' and depth of drop beam is 1'
External wall thickness = 8"
internal wall thickness = 4"

Solution:-

Length of four external walls = 26' x 2 + 12' x 2 = 76 Ft.
Deduction for length of column (horizontally) = 1' x 6 = 6'
Deduction for length of column (vertically) = 1' x 4 = 4'

Total length of external wall = 76' - 6' - 4' = 66 Ft

(i). Volume of external wall :- .= L x B x D
external wall thickness = 8" .= 66 x 0.666 x 9'
.= 0.666 Ft .= 395.604 Ft^3
Height of Ceiling = 10'
Depth of Drop beam = 1'
Total height of wall = 10' -1' = 9 Ft

(ii). Deduction of openings :-
(a). Volume of Doors = L x B x D x No.s
.= 3.5' x 0.666' x 7' x 2
.= 32.634 ft^3

(b). Volume of Lintels = L x B x D x Nos.

L = 3'6" + ℰ .= 4.1666 x 0.666 x 0.333

add 4" bea .= 0.924 Ft^3

each side of door

(iii) Total volume of Brick work for external wall = 395.604 - 32.634 - 0.924

.= 362.046 Ft^3

(iv). Volume of internal wall = L x B x D

.= 10' x 0.333 x 9'

.= 29.97 Ft^3

Length of internal wall = 12' - 1' - 1' = 10'

wall thickness = 4" = 0.333 Ft

(v). Total Volume of Brick work = 362.046 + 29.97 = 392.016 Ft^3

(vi). Vol. of each Brick = L x B x D

.= 9" x 4" x 3"

.= 108" ^{3} = 0.0625Ft^3

$108"^3$ = ? Ft^3

since 1' = 12"

.=108/ 12^3

.= 0.0625 Ft^3

(vii). No. of Bricks required = Volume of Brick work / Volume of each Brick

.= 392.016 / 0.0625

.= 6272.256 bricks

.= approximately equal to 6273 bricks

(viii). C:M required for Brick work with ratio 1:6

(a). Sand = 1.0 M^3 = 0.20 M^3

11.109 m^3 = ?

.= 11.109 x 0.20

.= 2.221 m^3

volume of brick work = 392.016 Ft^3

392.016 Ft^3 = ? M^3

since 1.0 m = 3.28 Ft

.= 392.016 / 3.28^3

.= 11.109 m^3

Sand in terms of weight :-

weight of sand / m^3 = 1.75 tons

1.0m^3 = 1.75 tons

2.221m^3 = ?

1.75 x 2.221 = 3.886 tons

(b). Cement required for brick work :-

$1.0m^3$ = (0.20 x 1440) / last digit of ratio

.= (0.20 x 1440) / 6

.= 48.0 kgs

$1.0m^3$ = 48 kgs

$11.109\ m^3$ = ?

.= 11.109 x 48

.= 533.232 kgs

Each bag of cement = 50kgs

no. of bags required = 533.232 / 50

.= 10.664 bags

.= approximately equal to 11 bags

PLASTERING CALCULATIONS

Plastering is done in two coats

(i). 1st coat or rough coat with thickness of plaster = 12mm

(ii). 2nd coat of plaster with thickness of plaster = 8mm

Total thickness of plaster = 20mm

Cement : Mortar required for 1.0m^3 of Plastering					
S.no.	Ratio or Dry Proportion	Sand in m^3	Cement in kgs	Cement in bags	Cement in m^3
1	1:06	1.25	300	6	0.208
2	1:05	1.25	360	7.2	0.25
3	1:04	1.25	450	9	0.312
4	1:03	1.25	600	12	0.416

C:M required for 1.0m^3 of Plastering

(i). Sand = for 1.0m^3 = 1.25m^3 constant

(ii). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / last digit of ratio

C:M required for 1.0m^3 of Plastering with ratio 1:6

(i). Sand = for 1.0m^3 = 1.25m^3 constant

(ii). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 6

.= 300 kgs

Each bag of cement = 50kgs

No. of cement bags = 300/50 = 6 bags

weight of cement/m^3 = 1440kgs

1440kgs = 1.0m^3

300kgs = ? M^3

.= 300/1440 = 0.208m^3

Problem-1 :-

For an Area of 1600 Ft^2 for plastering find C:M required with ratio 1:6 and 1:3

Solution:-

Area of plaster = 1600 Ft^2

.= 148.72 m^2

1600 Ft^2 = ? M^2

since 1m = 3.28Ft

.= 1600/3.28^2

.= 148.72m^2

(i). Cement : Mortar required for 1st coat of Plaster with ratio 1:6 :-

note: thickness of plaster for 1st coat = 12mm = 0.012m

Volume of Plaster = Area of Plaster x Thickness of Plaster

.= 148.72 x 0.012

.= 1.784m^3

T = 12mm = 0.012m

(a). Sand = for 1.0m^3 = 1.25m^3

1.784m^3 = ?

.= 1.784 x 1.25

.= 2.23 m^3

(b). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 6 = 300kgs

for 1.0m^3 = 300kgs

1.784m^3 = ?

.= 1.784 x 300

.= 535.2 kgs

(ii). Cement : Mortar required for 2nd coat of Plaster with ratio 1:3 :-

note: thickness of plaster for 2nd coat = 8mm = 0.008m

Volume of Plaster = Area of Plaster x Thickness of Plaster

.= 148.72 x 0.008

.= 1.189m^3

(a). Sand = for 1.0m^3 = 1.25m^3

1.189m^3 = ?

.= 1.189 x 1.25

.= 1.486 m^3

(b). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 3

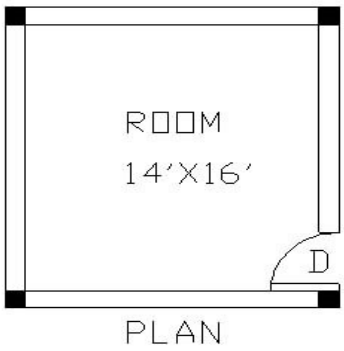
.= 600kgs

for 1.0m^3 = 600kgs

1.189m^3 = ?

.= 1.189 x 600 = 713.4 kgs

Problem - 2 :-



Find (i). Internal and External plaster area

(ii). C:M required with ratio 1:6 and 1:3

if height of Ceiling = 10'

Slab thickness = 6"

size of door = 3'6" x 7'

wall thickness = 9"

Depth of Drop beam = 1'

Solution :-

(i). Internal Plaster area :-

(a). Ceiling Plaster area :- L x B = 14 x 16 = 224 Ft^2

(b). Wall Plaster area :- L x D = 60 x 10 = 600 Ft^2

Length of four walls = (14 + 16) x 2 = 60Ft

Height of Ceiling = 10'

(c). Deduction of Door = L x D = 3.5' x 7' = -24.5 Ft^2

Total internal plaster area = 224 + 600 - 24.5 = 799.5 Ft^2

(ii). External Plaster area :-

(a). Length of four walls = (15.50 + 17.50) x 2 = 66.0 Ft

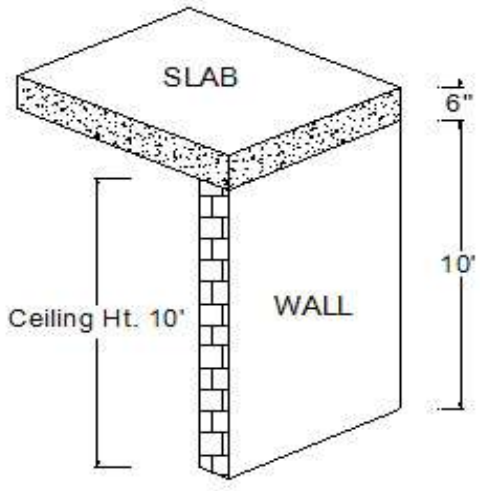
L = 14' + 0.75 + 0.75 = 15.50 Ft

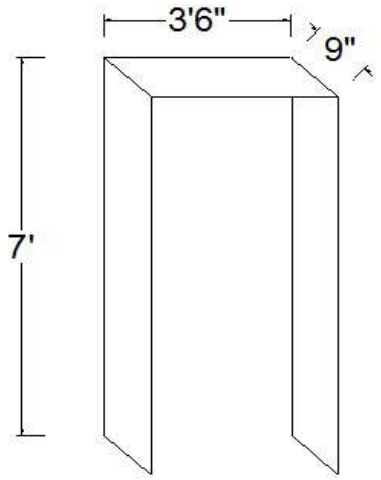
B = 16' + 0.75 + 0.75 = 17.50 Ft

9" = ? Ft

since 1' = 12"

8/12 = 0.75Ft





External Plaster area = L x D = 66' x 10.5' = 693.0 Ft^2

Height of Ceiling = 10'

Slab thickness = 6" = 0.5'

Total Height of external wall including slab thickness = 10.5'

(b). Internal plaster area for Door = L x B = 17.5 x 0.75 = 13.125 Ft^2

Size of Door = 3'6" x 7'

Length of Door = 3.5' + 7' + 7' = 17.5 Ft

thickness of wall = 9" = 0.75 Ft

(c). Deduction of Door from external wall = L x D = 3.5' x 7' = - 24.5 Ft^2

(d). Total external Plaster area = 693.0 + 13.125 - 24.5 = 681.625Ft^2

(iv). Total Plaster area = internal + external

.= 799.5 + 681.625

.= 1481.125 Ft^2

(v). Cement : Mortar required for 1st coat of Plaster with ratio 1:6 :-

Volume of Plaster = Area of Plaster x Thickness of Plaster

.= 137.671 x 0.012

.= 1.652 m^3

note: thickness of plaster for 1st coat = 12mm = 0.012m

1481.125 Ft^2 = ? M^2

since 1m = 3.28Ft

.= 1481.125/3.28^2

.= 137.671 m^2

(a). Sand = for 1.0m^3 = 1.25m^3

1.642 m^3 = ?

.= 1.652 x 1.25

.= 2.065 m^3

(b). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 6

.= 300kgs

for 1.0m^3 = 300kgs

1.652 m^3 = ?

.= 1.652 x 300

.= 495.6 kgs

(vi). Cement : Mortar required for 2nd coat of Plaster with ratio 1:3 :-

Volume of Plaster = Area of Plaster x Thickness of Plaster

.= 137.671 x 0.008

.= 1.101m^3

note: thickness of plaster for 2nd coat = 8mm = 0.008m

(a). Sand = for 1.0m^3 = 1.25m^3

1.101.m^3 = ?

.= 1.101 x 1.25

.= 1.376 m^3

(b). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 3

.= 600kgs

for 1.0m^3 = 600kgs

1.101m^3 = ?

.= 1.101 x 600

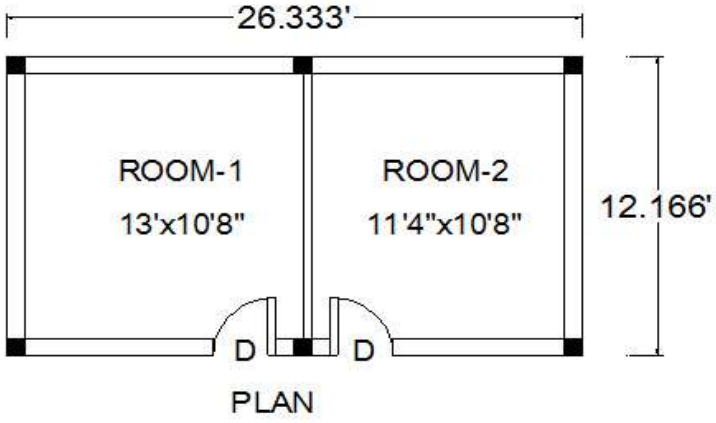
.= 660.6 kgs

Problem-3 :-

Find (i). Internal and External plaster area (ii). C:M required with ratio 1:6 and 1:3

if height of Ceiling = 10' Slab thickness = 6" ; size of door = 3'6" x 7'

External wall thickness = 9" ; internal wall thickness = 6" ; Depth of Drop beam = 1'



Solution :-

8" = ? Ft

since 1' = 12"

8/12 = 0.666Ft

4" = ? Ft

since 1' = 12"

4/12 =0.333Ft

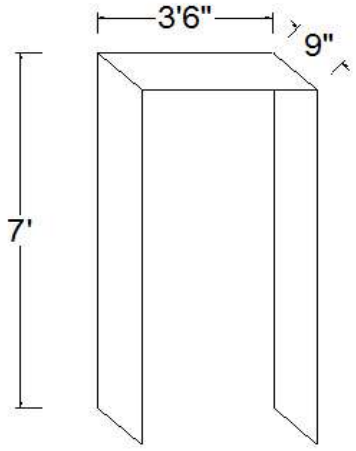
<u>(i). Internal Plaster area :-</u>

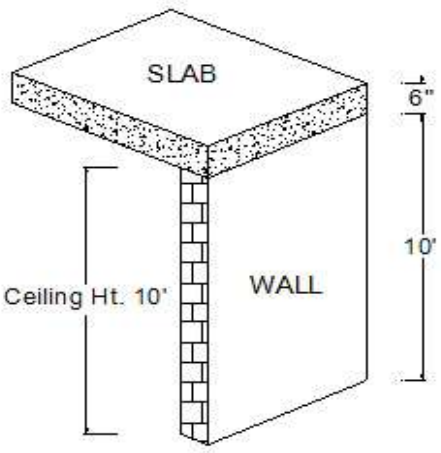
(a). Ceiling Plaster area :-

1. Room-1 = L x B = 13 x 10.666 = 138.658 Ft^2

2. Room-2 = L x B = 11.333 x 10.666 = 120.877 Ft^2

Total Ceiling Plaster area = 138.658 + 120.877 = 259.535 Ft^2





(b). Wall Plaster area :-

1. Room-1 = L x D = 47.332 x 10 = 473.32 Ft^2

Length of four walls = (13 + 10.666) x 2 = 47.332Ft

Height of Ceiling = 10'

2. Room-2 = L x D = 43.998 x 10 = 439.98 Ft^2

Length of four walls = (11.333 + 10.666) x 2 = 43.998Ft

Height of Ceiling = 10'

(c). Deduction of Door = L x D x No.s = 3.5' x 7' x 2 = - 49.0 Ft^2

Total internal plaster area = Ceiling plaster area + Wall plaster area

.= 259.535 + 473.32 + 439.98 - 49 = 1123.835 Ft^2

(ii). External Plaster area :-

(a). Length of four external walls = (26.333 + 12.166) x 2 = 76.998 Ft

6" = ? Ft

since 1' = 12"

6/12 = 0.5Ft

External Plaster area = L x D = 76.998' x 10.5' = 808.479 Ft^2

Height of Ceiling = 10'

Slab thickness = 6" = 0.5'

Total Height of external wall including slab thickness = 10' + 0.5' = 10.5'

(b). Internal plaster area for Door = L x B x No.s = 17.5 x 0.75 x 2 = 26.25 Ft^2

Size of Door = 3'6" x 7'

Length of Door = 3.5' + 7' + 7' = 17.5 Ft

thickness of wall = 9" = 0.75 Ft

(c). Deduction of Door from external wall = L x D x No.s = 3.5' x 7' x 2 = - 49.0 Ft^2

(d). Total external Plaster area = 808.479 + 26.25 - 49.0 = 785.729Ft^2

(iv). Total Plaster area = internal + external

.= 1123.835 + 785.729

.= 1909.564 Ft^2

1909.564 Ft^2 = ? M^2

since 1m = 3.28Ft

.= 1909.564 / 3.28^2

.= 177.495 m^2

(v). Cement : Mortar required for 1st coat of Plaster with ratio 1:6 :-

Volume of Plaster = Area of Plaster x Thickness of Plaster

.= 177.495 x 0.012

.= 2.129 m^3

note: thickness of plaster for 1st coat = 12mm = 0.012m

(a). Sand = for 1.0m^3 = 1.25m^3

2.129 m^3 = ?

.= 2.129 x 1.25

.= 2.661 m^3

(b). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 6

.= 300kgs

for 1.0m^3 = 300kgs

2.129 m^3 = ?

.= 2.129 x 300

.= 638.7 kgs

(vi). Cement : Mortar required for 2nd coat of Plaster with ratio 1:3 :-

Volume of Plaster = Area of Plaster x Thickness of Plaster

.= 177.495 x 0.008

.= 1.419 m^3

note: thickness of plaster for 2nd coat = 8mm = 0.008m

(a). Sand = for 1.0m^3 = 1.25m^3

1.419 m^3 = ?

.= 1.419 x 1.25

.= 1.773 m^3

(b). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 3

.= 600kgs

for 1.0m^3 = 600kgs

1.419 m^3 = ?

.= 1.419 x 600

.= 851.4 kgs

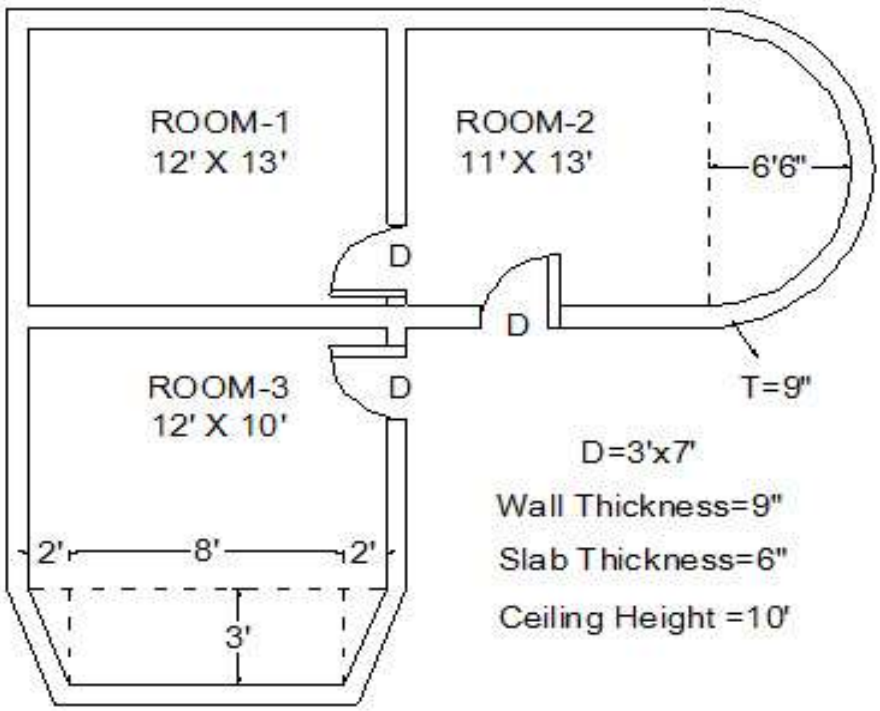
Problem-4 :-

From the given plan find

(i). Internal and External Plastering Area and (ii). C:M required with ratio 1:6 and 1:3

if height of Ceiling = 10' Slab thickness = 6" size of door = 3' x 7'

wall thickness = 9" Depth of Drop beam = 1'



PLAN OF THREE ROOMS

Solution :-

(i). Internal Plaster area :-

(a). Ceiling Plaster area :-

1. Room-1 = L x B = 12' x 13' = 156 Ft^2

9" = ? Ft

since 1' = 12"

9/12 = 0.75Ft

2. Room-2 :-

Part-1 = L x B = 11' x 13' = 143Ft^2

Part-2 = $(\pi/4) \times d^2 \times 0.5 = (\pi/4) \times 13^2 \times 0.5 = 66.366\ Ft^2$

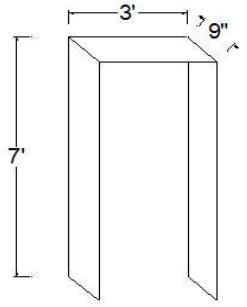
3. Room-3 :-

Part-1 = L x B = 12' x 10' = 120Ft^2

Part-2 = 0.5 x (a+b) x h = 0.5 x (8'+12') x 3' = 30.0Ft^2

Total Ceiling Plaster area = 156 + 143 + 66.366 + 120 + 30 = 515.366 Ft^2

(b). Wall Plaster area :-



1. Room-1 = L x D = 50' x 10' = 500 Ft^2
Length of four walls = (12 + 13) x 2 = 50.0Ft
Height of Ceiling = 10'

2. Room-2 = L x D = 55.42 x 10 = 554.2 Ft^2
Peripheral Length of walls =(11' + 2 x π x 6.5' x 0.5 + 11' + 13)= 55.42Ft
Height of Ceiling = 10'

3. Room-3 = L x D = 47.21' x 10' = 472.1Ft^2
Peripheral Length of walls = (12' + 10' + 3.605 + 8' + 3.605' + 10') = 47.21Ft
Height of Ceiling = 10'

According to pythogorous theorm inclined length = $V(a^2 + b^2)$ 9" = ? Ft
.= $V(2^2 + 3^2)$ since 1' = 12"
.= 3.605Ft 9/12 = 0.75Ft

Total wall plaster area = 500 + 554.2 + 472.1 = 1526.3 Ft^2

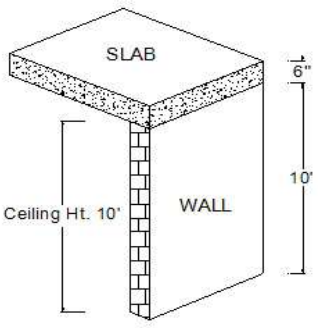
(c). Deduction of Door = L x D x No.s = 3' x 7' x 4 = -84.0 Ft^2

Total internal plaster area = Ceiling plaster area + Wall plaster area - Door area
.= 515.366 + 1526.3 - 84 = 1957.666 Ft^2

(ii). External Plaster area :-

(a). Length of external walls =
.= (99" + 12' + 9" + 11' + 2 x π x r x 0.5 + 11' + 10' + 4.65' + 8' + 4.65' + 10' + 9" + 13' + 9")
.= (0.75' + 12' + 0.75' + 11' + 2 x π x 7.25' x 0.5 + 11' + 10' + 4.65' + 8' + 4.65' + 10' + 0.75' + 13' + 0.75') = 110.076 Ft

According to pythogorous theorm inclined length = $V(a^2 + b^2)$
.= $V(2.75^2 + 3.75^2)$
.= 4.65Ft



External Plaster area = L x D = 110.076' x 10.5' = 1155.798 Ft^2
Height of Ceiling = 10'
Slab thickness = 6" = 0.5'
Total Height of external wall including slab thickness = 10' + 0.5' = 10.5'

(b). Internal plaster area for Door = L x B x No.s = 17 x 0.75 x 3 = 38.25 Ft^2

Size of Door = 3' x 7'

Length of Door = 3' + 7' + 7' = 17 Ft

thickness of wall = 9" = 0.75 Ft

(c). Deduction of Door from external wall = L x D x No.s = 3' x 7' x 2 = - 42.0 Ft^2

(d). Total external Plaster area = 1155.798 + 38.25 - 42.0 = 1152.048Ft^2

(iv). Total Plaster area = internal + external

.= 1957.666 + 1152.048

.= 3109.714 Ft^2

3109.714 Ft^2 = ? M^2

since 1m = 3.28Ft

.= 3109.714 / 3.28^2

.= 289.049 m^2

(v). Cement : Mortar required for 1st coat of Plaster with ratio 1:6 :-

Volume of Plaster = Area of Plaster x Thickness of Plaster

.= 289.049 x 0.012

.= 3.468 m^3

note: thickness of plaster for 1st coat = 12mm = 0.012m

(a). Sand = for 1.0m^3 = 1.25m^3

3.468 m^3 = ?

.= 3.468 x 1.25

.= 4.335 m^3

(b). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 6

.= 300kgs

for 1.0m^3 = 300kgs

3.468 m^3 = ?

.= 3.468 x 300

.= 1040.4 kgs

(vi). Cement : Mortar required for 2nd coat of Plaster with ratio 1:3 :-

Volume of Plaster = Area of Plaster x Thickness of Plaster

.= 289.049 x 0.008

.= 2.312 m^3

note: thickness of plaster for 2nd coat = 8mm = 0.008m

(a). Sand = for 1.0m^3 = 1.25m^3

2.312 m^3 = ?

.= 2.312 x 1.25

.= 2.89 m^3

(b). Cement in kgs = for 1.0m^3 = (1.25 x 1440) / 3

.= 600kgs

for 1.0m^3 = 600kgs

2.312 m^3 = ?

.= 2.312 x 600

.= 1387.2 kgs

FLOORING AND SKIRTING CALCULATIONS

Various types of Flooring :-

1. Marble Flooring
2.Vetrified Tiles Flooring
3. Inter-lock Tiles Flooring etc.

Problem-1 :-

For a Room of size 40' x 30' with Floor Area of 1200 Ft^2 find,
(i). no. of floor tiles required for flooring and Skirting,
if size of each floor tile = 12" x 12" and Height of Skirting = 4"
(ii). Cement : Mortar required for laying Floor tiles with ratio 1:10
(iii). Cement required for sticking Skirting to walls

Solution :-

(i). Floor Tiles required for Flooring and Skirting :-

1. Total Floor area = 1200 Ft^2
2. Area of each tile = 12" x 12"
.= 1' x 1'
.= 1.0Ft^2

3. Required no. of Floor tiles = Total floor area / area of each tile
.= 1200/1.0
.= 1200 tiles

4. Skirting calculation will be done in running feet:
(a). Peripheral Length of Room = (L + B) x 2
.= (40' + 30') x 2
.= 140 Ft

(b). Height of Skirting = 4" = 0.333Ft

(c). Area of Skirting = L x D = 140.0 x 0.333 = 46.62 Ft^2

(d). No. of tiles required for Skirting = Area of Skirting / Area of each tile
Given area of each tile = 1' x 1' = 1.0Ft^2
.= 46.62 / 1.0
.= 46.62 or approximately equal to 47 tiles

(ii). Cement : Mortar required for laying Floor tiles with ratio 1:10 :-

Area of Flooring = 1200Ft^2

thickness of C : M layer = 2" = 0.166Ft

Volume of C : M required for laying floor tiles = Area of Flooring x thickness of C : M layer

.= 1200 x 0.166

.= 199.20 Ft^3

199.20 Ft^3 = ? M^3

Since 1.0m = 3.28Ft

.= 199.20 / 3.28^3

.= 5.645m^3

Standards :-

(a). Quantity of Sand required : for 1.0m^3 of C:M = 1.25m^3 Constant value

(b). Quantity of Cement required : for 1.0m^3 of C:M =(1.25 x 1440) / last digit of c:m ratio

(1). Quantity of Sand required : for 1.0m^3 = 1.25m^3

5.645m^3 = ?

.= 5.645 x 1.25

.= 7.056m^3

(2). Quantity of Cement required : for 1.0m^3 = (1.25 x 1440) / 10

.= 180.0kgs

5.645m^3 = ?

.= 5.645 x 180.0

.= 1016.10 kgs

each bag of cement = 50 kgs

no. of cement bags required = 1016.10 / 50 = 20.322 or approximately equal to 21 bags

(iii). Cement required for sticking Skirting to walls :-

Area of Skirting = 46.62 Ft^2

thickness of Cement layer = 4mm = 0.0131 Ft

4mm = ? Ft

Since 1" = 25.4mm

.= 4/25.4

.=0.1574"

since 1' = 12"

.= 0.1574/12

.= 0.0131 Ft

Volume of Cement required = Area of Skirting x thickness of cement layer

.= 46.62 x 0.0131

.= 0.610 Ft^3

.= 0.0172m^3

Standard weight of cement/m^3 = 1440kgs

1.0m^3 = 1440kgs

0.0172m^3 = ? Kgs

.= 0.0172 x 1440

.= 24.768kgs

each bag of cement = 50 kgs

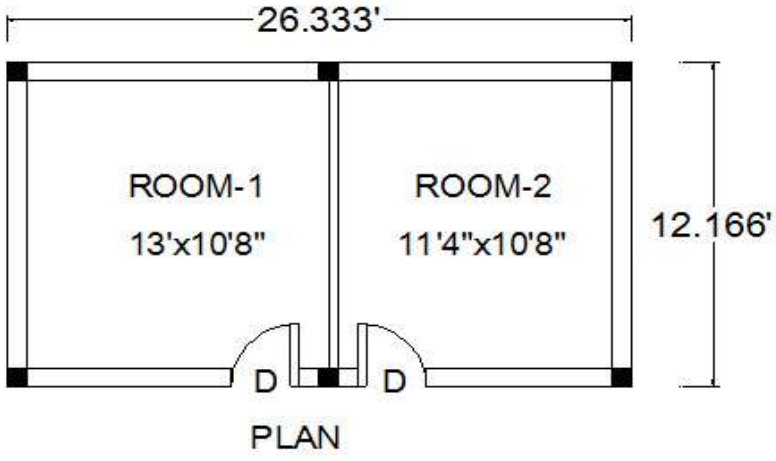
no. of cement bags required = 24.764 / 50 = 0.495 or approximately equal to 1 bags

Problem-2 :-

From the given plan of two rooms find,

(i). No. of Floor tiles required for Flooring & Skirting, if size of each tile = 18" x 30" and Height of Skirting = 6" (ii). Cement : Mortar required for laying Floor tiles with ratio 1:8

(iii). Cement required for sticking Skirting to walls.



PLAN

Solution :-

(i). Floor Tiles required for Flooring and Skirting :-

Floor Area:-

1. Room-1 = L x B
   .= 13' x 10'8"
   .= 13' x 10.666'
   .= 138.658 Ft^2

2. Room-2 = L x B
   .= 11'4" x 10'8"
   .= 11.333' x 10.666'
   .= 120.877 Ft^2

Total Floor area = 138.658 + 120.877 = 259.535 Ft^2

2. Area of each tile = 18" x 30"
   .= 1.5' x 2.5'
   .= 3.75Ft^2

3. Required no. of Floor tiles = Total floor area / area of each tile
   .= 259.535 / 3.75
   .= 69.20 tiles or approximately equal to 70 tiles

4. Skirting calculation will be done in running feet:

(a). Peripheral Length of Room-1 = (L + B) x 2
   .= (13' + 10'8"') x 2
   .= (13' + 10.666') x 2
   .= 47.332 Ft

(b). Peripheral Length of Room-2 = (L + B) x 2
   .= (11'4" + 10'8"') x 2
   .= (11.333' + 10.666') x 2
   .= 43.998 Ft

(c). Total length of Skirting = 47.332 + 43.998 = 91.33 Ft

(d). Height of Skirting = 6" = 0.50Ft

(c). Area of Skirting = L x D = 91.33 x 0.50 = 45.665 Ft^2

(d). No. of tiles required for Skirting = Area of Skirting / Area of each tile

Given area of each tile = 1.5' x 2.5' = 3.75Ft^2
   .= 45.665 / 3.75
   .= 12.177 or approximately equal to 13 tiles

(ii). Cement : Mortar required for laying Floor tiles with ratio 1:8 :-

Area of Flooring = 259.535Ft^2

thickness of C : M layer = 2" = 0.166Ft

Volume of C : M required for laying floor tiles = Area of Flooring x thickness of C : M layer

.= 259.535 x 0.1666

.= 43.238 Ft^3

43.238 Ft^3 = ? M^3

Since 1.0m = 3.28Ft

.= 43.238 / 3.28^3

.= 1.225m^3

Standards :-

(a). Quantity of Sand required : for 1.0m^3 of C:M = 1.25m^3 Constant value

(b). Quantity of Cement required : for 1.0m^3 of C:M=(1.25 x 1440) / last digit of c:m ratio

(1). Quantity of Sand required : for 1.0m^3 = 1.25m^3

1.225m^3 = ?

.= 1.225 x 1.25

.= 1.531m^3

(2). Quantity of Cement required : for 1.0m^3 = (1.25 x 1440) / 8

.= 225.0kgs

1.225m^3 = ?

.= 1.225 x 225.0

.= 275.625 kgs

each bag of cement = 50 kgs

no. of cement bags required = 275.625 / 50 = 5.51 or approximately equal to 6 bags

(iii). Cement required for sticking Skirting to walls :-

Area of Skirting = 45.665 Ft^2

thickness of Cement layer = 4mm = 0.0131 Ft

Volume of Cement required = Area of Skirting x thickness of cement layer

.= 45.665 x 0.0131

.= 0.598 Ft^3

.= 0.0169m^3

Standard weight of cement/m^3 = 1440kgs

1.0m^3 = 1440kgs

0.0169m^3 = ? Kgs

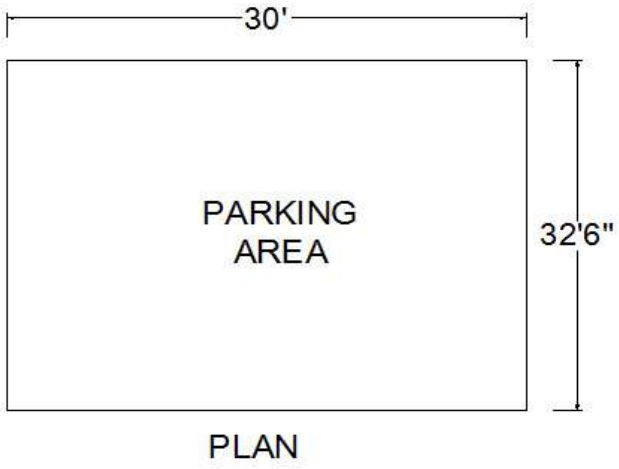
.= 0.0169 x 1440

.= 24.336kgs

each bag of cement = 50 kgs

no. of cement bags required = 24.336 / 50 = 0.486 or approximately equal to 1 bags

Problem-3:-



PLAN

From the given figure, Find

(i). No. of inter-lock tiles to be layed in Parking Area with Inter-lock tile specification that, an area of 12.0Ft^2 will cover 30 no. of tiles.

(ii). C:M required for laying Inter-lock tiles in parking area with ratio 1 : 10

Solution :-

(i). Required no. of Inter-lock tiles:-

Area of Parking = L x B = 30' x 32'6"

.= 30' x 32.5'

.= 975.0Ft^2

Given specification for Inter-lock tiles = 30 tiles will cover 12.0Ft^2 area

12.0 Ft^2 = 30 tiles

975.0 Ft^2 = ? Tiles

.= (975.0 / 12.0) x 30

.= 2437.5 tiles or approximately equal to 2438 tiles

(ii). C:M required for laying Inter-lock tiles in parking area with ratio 1 : 10:-

Area of Inter-lock tiles = 975.0Ft^2

thickness of C : M layer = 2" = 0.166Ft

Volume of C : M required for laying floor tiles = Area of Inter-lock tiles x thickness of C : M layer

.= 975.0 x 0.1666

.= 162.435 Ft^3

162.435 Ft^3 = ? M^3

Since 1.0m = 3.28Ft

.= 162.435 / 3.28^3

.= 4.603m^3

Standards :-

(a). Quantity of Sand required : for 1.0m^3 of C:M = 1.25m^3 Constant value

(b). Quantity of Cement required : for 1.0m^3 of C:M=(1.25 x 1440) / last digit of c:m ratio

(1). Quantity of Sand required : for 1.0m^3 = 1.25m^3

4.603m^3 = ?

.= 4.603 x 1.25

.= 5.753m^3

(2). Quantity of Cement required : for 1.0m^3 = (1.25 x 1440) / 10

.= 180.0kgs

4.603m^3 = ?

.= 4.603 x 180.0

.= 828.54 kgs

each bag of cement = 50 kgs

no. of cement bags required = 828.54 / 50 = 16.57 or approximately equal to 17 bags

WALL TILE CALCULATIONS

Ceramic Tile or Vitrified Tiles for walls :-

Problem-1 :-

From the given plan of Toilet, Find

(i). Required no. of wall tiles, if size of each wall tile = 9" x 12"

wall tiles shall be provided up to Ceiling height

Height of Ceiling = 10'

Size of Door = 2'6" x 7'

Size of Ventilator = 3' x 2'

(ii). Cement required for sticking wall tiles

PLAN OF TOILET

Solution:-

(i). Required no. of wall tiles :-

1. Wall Tile area = L x D = 30' x 10' = 300.0Ft^2

Where,

L = Peripheral length of four wall

D = Ht. of Ceiling = 10' given

L = (L + B) x 2

L = (7' + 8') x 2 = 30 Ft

2. Deduction of openings i.e., Door area & Ventilator area

Door area = L x D = 2'6" x 7' = 17.5 Ft^2

Ventilator area = L x D = 3' x 2' = 6.0 Ft^2

Total area = 23.50 Ft^2

3. Wall Tile area after deductions = 300.0 - 23.50 = 276.50 Ft^2

$108"^2$ = ? Ft
Since 1' = 12"
.= $108 / 12^2$
.= 0.75 Ft

4. Area of each wall tile = L x D = 9" x 12" = $108"^2$ = 0.75 Ft^2

5. No. of Wall Tiles required = Total wall tile area / area of each wall tile
.= 276.50 / 0.75
.= 368.666 or approximately equal to 369 wall tiles

(ii). Cement required for sticking wall tiles :-

Area of Wall tiles = 276.50 Ft^2
Thickness of Cement layer = 4mm = 0.0131 Ft
Volume of Cement required = Area of wall tiles x thickness of Cement layer
.= 276.50 x 0.0131
.= 3.622 Ft^3
.= 0.102 m^3

4mm = ? Ft
Since 1" = 25.4mm
.= 4/25.4
.= 0.1574"
0.1574" = ? Ft
Since 1' = 12"
.= 0.1574 / 12
.= 0.0131 Ft

3.622 Ft^3 = ? M^3
Since 1m = 3.28Ft
.= $3.622 / 3.28^3$
.= 0.102 m^3

Standard weight of Cement / m^3 = 1440kgs

for 1.0m3 = 1440 kgs
0.102 m3 = ? Kgs
.= 0.102 x 1440
.= 146.88 kgs

each bag of cement = 50.0 kgs
No. of Cement bags required = 146.88 / 50
.= 2.93 or approximately equal to 3 bags of cement

Problem-2 :-

From the given plan of Toilet, Find

(i). Required no. of wall tiles, if size of each wall tile = 24" x 12"

wall tiles shall be provided up to Door Sill level

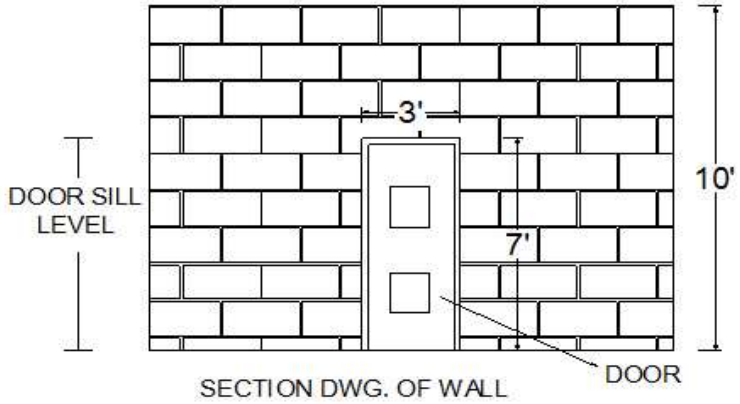
Height of Ceiling = 10'

Size of Door = 2'6" x 7'

Size of Ventilator = 3' x 2'

(ii). Cement required for sticking wall tiles

PLAN OF TOILET



SECTION DWG. OF WALL

Solution:-

(i). Required no. of wall tiles :-

Sill level = Door height = 7'

1. Wall Tile area = L x D = 32.5' x 7' = 227.5 Ft^2

Where,

L = Peripheral length of four wall

D = Height up to Door Sill level = 7'

L = (L + B) x 2

L = (7'6" + 8'9") x 2 = 32.50 Ft

2. Deduction of openings i.e., Door area & Ventilator area

Door area = L x D = 2'6" x 7' = 17.5 Ft^2

Ventilator area = L x D = 3' x 2' = 6.0 Ft^2

Total area = 23.50 Ft^2

3. Wall Tile area after deductions = 227.50 - 23.50 = 204.0 Ft^2

4. Area of each wall tile = L x D = 24" x 12" = 288"^{2} = 2.0 Ft^2

288"^{2} = ? Ft

Since 1' = 12"

.= 288 / 12^2

.= 2.0 Ft

5. No. of Wall Tiles required = Total wall tile area / area of each wall tile

.= 204.0 / 2.0

.= 102 wall tiles required

(ii). Cement required for sticking wall tiles :-

Area of Wall tiles = 204.0 Ft^2

Thickness of Cement layer = 4mm = 0.0131 Ft

Volume of Cement required = Area of wall tiles x thickness of Cement layer

.= 204.0 x 0.0131

.= 2.672 Ft^3

.= 0.0757 m^3

4mm = ? Ft

Since 1" = 25.4mm

.= 4/25.4

.= 0.1574"

0.1574" = ? Ft

Since 1' = 12"

.= 0.1574 / 12

.= 0.0131 Ft

2.672 Ft^3 = ? M^3

Since 1m = 3.28Ft

.= 2.672 / 3.28^3

.= 0.0757 m^3

Standard weight of Cement / m^3 = 1440kgs

for 1.0m3 = 1440 kgs

0.0757 m3 = ? Kgs

.= 0.0757 x 1440

.= 109.008 kgs

each bag of cement = 50.0 kgs

No. of Cement bags required = 109.008 / 50

.= 2.18 or approximately equal to 3 bags of cement

Problem-3 :-

From the given plan of Kitchen, Find

(i). Required no. of wall tiles, if size of each wall tile = 18" x 12"

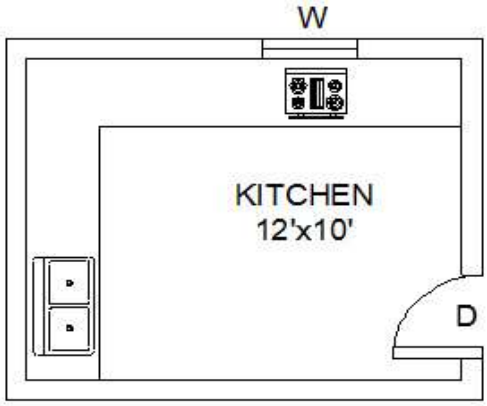
wall tiles shall be provided up to height 2'9" above kitchen platform.

Height of Ceiling = 10'

Size of Door = 3' x 7'

Size of Window = 3' x 3'

(ii). Cement required for sticking wall tiles



PLAN OF KITCHEN

Solution:-

(i). Required no. of wall tiles :-

1. Wall Tile area = L x D = 22' x 2.75' = 60.50 Ft^2

Where,

L = length of two diagonal wall

D = Height of wall tiles to be provided above kitchen platform i.e., 2'9" given

L = 12' + 10' = 22'

D = 2'9"

2. Deduction of openings i.e., Window area

Window area = L x D = 3' x 3' = 9.0 Ft^2

3. Wall Tile area after deductions = 60.50 - 9.0 = 51.50 Ft^2

4. Area of each wall tile = L x D = 18" x 12" = 216"^{2} = 1.50 Ft^2

4mm = ? Ft

Since 1" = 25.4mm

.= 4/25.4

.= 0.1574"

0.1574" = ? Ft

Since 1' = 12"

.= 0.1574 / 12

.= 0.0131 Ft

216"^{2} = ? Ft

Since 1' = 12"

.= 216 / 12^2

.= 1.50 Ft

0.674 Ft^3 = ? M^3

Since 1m = 3.28Ft

.= 0.674 / 3.28^3

.= 0.0191 m^3

5. No. of Wall Tiles required = Total wall tile area / area of each wall tile

.= 51.50 / 1.50

.= 34.333 or approximately equal to 35 wall tiles required.

(ii). Cement required for sticking wall tiles :-

Area of Wall tiles = 51.50 Ft^2

Thickness of Cement layer = 4mm = 0.0131 Ft

Volume of Cement required = Area of wall tiles x thickness of Cement layer

.= 51.50 x 0.0131

.= 0.674 Ft^3

.= 0.0191 m^3

Standard weight of Cement / m^3 = 1440kgs

for 1.0m3 = 1440 kgs

0.0191 m3 = ? Kgs

.= 0.0191 x 1440

.= 27.504 kgs

each bag of cement = 50.0 kgs

No. of Cement bags required = 27.504 / 50

.= 0.55 or approximately equal to 1 bags of cement

FALSE CEILING CALCULATIONS

False Ceiling :

The Ceiling provided under the True Ceiling is Called as False Ceiling.

It is generally provided to have more interior look with eliminated florescent lights and also to hide Drop beams and HVAC Ducting (Heat, ventilation and air conditioning).

False Ceiling is done by means of material gypsum board and pop board (plaster of Paris)

Generally gypsum board is bit expensive then pop board.

The calculation of False Ceiling is done in terms of Area Calculation

Ceiling border Calculation is done in Running Feet

Extra money has to pay if Ceiling has offset design.

Problem-1 :-

Find Cost amount of False-Ceiling for a Room of size 15' x 18' with plain design along with the Ceiling border, by means of Gypsum board and Provide 20 no. of round Ceiling light. If, 1. Rate/SFt for Ceiling = 60.0 rupees, along with material and installation.
2. Rate/ running feet for Ceiling border = 35.0 rupees along with material and installation.
3. Rate/each round ceiling light = 650.0 rupees

Solution :-

Size of room = 15' x 18'
Area of False Ceiling = 15' x 18' = 270Ft^2
Length of Ceiling border = Peripheral length "L" = (L+B) x 2 = (15'+18') x 2 = 66Ft

1. Cost amount for Ceiling = Area of Ceiling x Rate/Ft^2 for Ceiling
.= 270 x 60
.= 16,200.0 rupees

2. Cost amount for Ceiling border = length of Ceiling border x Rate/ running feet
.= 66 x 35
.= 2310 rupees

3. Cost of Ceiling lights = Rate/each light x no. of lights
.= 650 x 20
.= 13,000 rupees

4. Total Cost =16,200 + 2,310 + 13,000 = 31,510.0 rupees

Problem-2 :-

Find Cost amount of False-Ceiling for a Room of size 20' x 30' with 1Ft off-set plain design along with the Ceiling border, by means of Gypsum board and Provide 30 no. of round Ceiling light. If,
1. Rate/SFt for Ceiling = 60.0 rupees, along with material and installation.
2. Rate/SFt for Ceiling off-set = 60.0 rupees, along with material and installation.
3. Rate/ running feet for Ceiling border = 35.0 rupees along with material and installation.
4. Rate/each round ceiling light = 350.0 rupees

Solution :-

Size of room = 20' x 30'

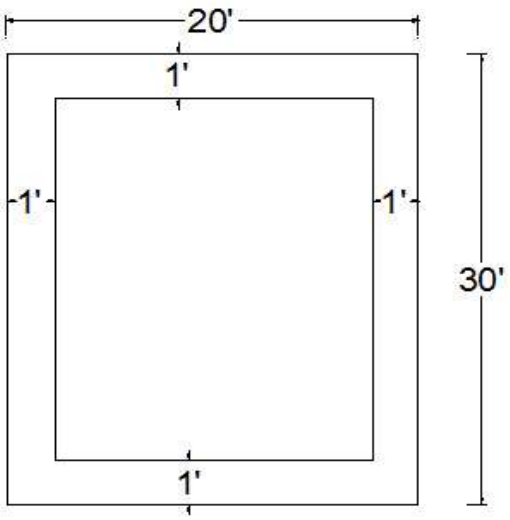
Area of False Ceiling = 20' x 30' = 600 Ft^2

Length of False Ceiling off-set = (20' + 28') x 2 = 96.0Ft

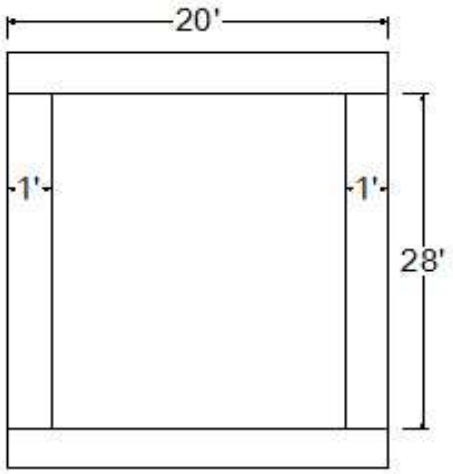
Area of False Ceiling off-set = L x B = 96' x 1' = 96.0 Ft^2

Length of Ceiling border :-

Peripheral length "L" = (L+B) x 2 = (20'+30') x 2 = 100 Ft



PLAN OF FALSE CEILING



PLAN OF FALSE CEILING

L = 20' x 2 + 28' x 2 = 96 FT

1. Cost amount for Ceiling = Area of Ceiling x Rate/Ft^2 for Ceiling

.= 600 x 60

.= 36,000 rupees

2. Cost amount for Ceiling Off-set = Area of Ceiling off-set x Rate/Ft^2 for Ceiling

.= 96.0 x 60

.= 5760.0 rupees

3. Cost amount for Ceiling border = length of Ceiling border x Rate/ running feet

.= 100 x 35

.= 3500 rupees

4. Cost of Ceiling lights = Rate/each light x no. of lights

.= 350 x 30

.= 10,500 rupees

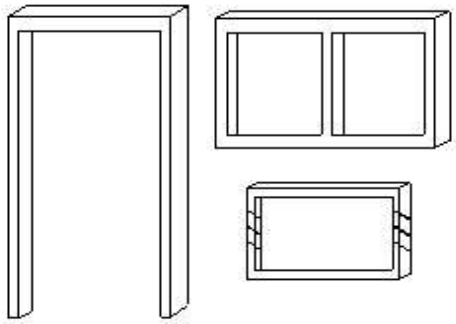
5. Total Cost = 36,000 + 5760 + 3500 + 10500 = 55,760 rupees

Note :- If any Ceiling to be design with heavy decoration with expensive light then, the calculation of False-Ceiling will be done interms of Ceiling area only but the rate/Ft^2 will be more than normal rates

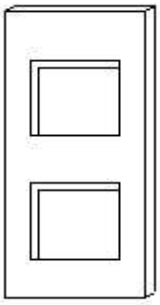
WOOD CALCULATIONS FOR DOORS AND WINDOWS

Types of Wood:

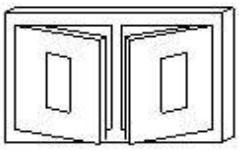
1	Teak Wood	Very expensive - Used for Doors and windows
2	Sal-wood	Economical- Used for Door Frames
3	Flush wood	Cheaper- Used for Door Shutters
4	Plywood	Economical Used for Wardrobes, Shelves and Cup-board
5	Nova pan	Cheaper- used for Tables and Chairs [with dust partials of wood]
6	Rubber wood	Cheaper- but not recommended, as it has expansion and contraction due to weather conditions



FRAME WITH SAL-WOOD



DOOR SHUTTER
WITH FLUSH WOOD



WINDOW SHUTTER
WITH TEAK WOOD

In olden day people use to measure the quantity of wood required to make Doors & Window and according to measurement they will buy the wood from the market and let the carpenter to make Doors & Windows on Site. Presently Doors & Windows are available in ready-made to safe the time and to get rid of man-power

Problem -1:-

Find Cost of Doors, of Size 3'6" x 7' along with Door shutter and Door frame if,
no. of Doors = 6 and section of Door frame = 3"x3"
Rate / Door frame = 2600 rupees and for Door shutter Rate / ft^2 = 110.0 rupees

Solution:-

1. Door Frames :

Given rate for each Door frame of size 3'6" x 7' with section of frame 3"x 3"= 2600 rupees
No. of Door frames = 6
Cost for Door frames = 2600 x 6 = 15,600/-

2. Door Shutters :

Given size of Door = 3'6" x 7'

.= 42" x 84"

Size of Door shutter area = L x H = 36" x 81" = $2916"^2$ = 20.25 Ft^2

length of Door shutter = 42" - 3" - 3" = 36"

Height of Door Shutter = 84" - 3" = 81"

$2916"^2$ = ? Ft^2

Since 1Ft = 12"

.= $2916 / 12^2$

.= 20.25 Ft^2

For Door Shutter given rate / Ft^2 = 110.0 rupees

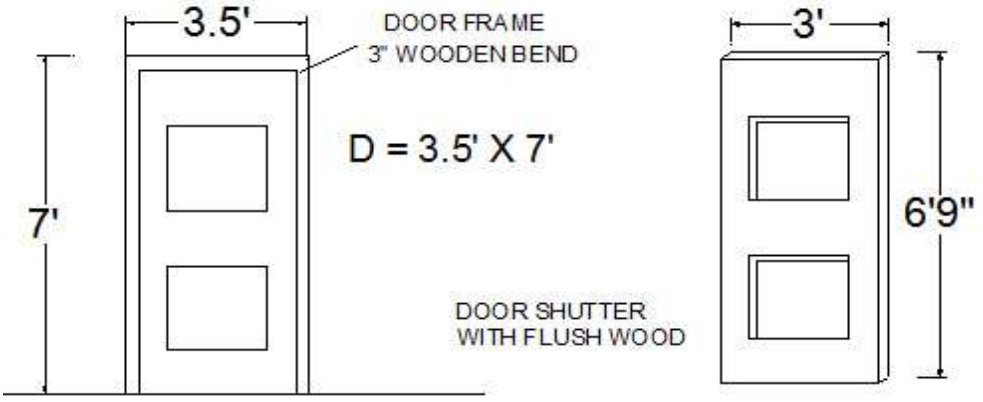
No. of Shutters = 6

Cost for Door Shutters = 110.0 x 20.25 x 6

.= 13,365/- rupees

Total cost for 6 Door Frames & Door Shutters = 15600 + 13365 = 28,965/-

Door shutters will be selling interms of area.



Problem -2:-

Find Cost of Windows, of Size 3' x 4' along with Window shutter and Window frame if,

no. of Windows = 4 and section of window frame = 3"x3"

Rate / Window frame = 2800 rupees and for Window shutter Rate / Window Shutter = 900.0 rupees

Solution:-

1. Window Frames :

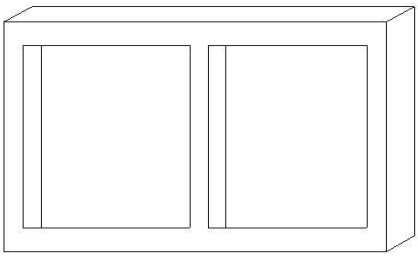
Given rate for each Window frame of size 3' x 4' with section of frame 3"x 3"=3200 rupees

No. of window frames = 4

Cost for window frames = 2800 x 4 = 11200/-

2. Window Shutters :

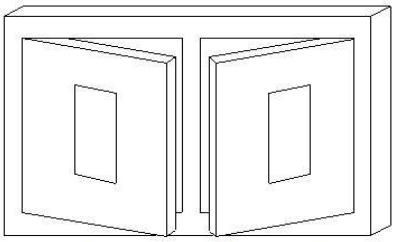
size of each window shutter = 13.5" x 42"



WINDOW FRAME

length of Window shutter = 36" - 3" - 3" - 3" = 27"
providing two shutter panels .= 27 / 2
in each window .= 13.5"

Height of Window Shutter = 48" - 3" - 3" = 42"



WINDOW SHUTTER

Given Rate/each window shutter = 900.0
No. of Shutters = 2 in each widow
No. of Windows = 4
Cost for Window Shutters = 900 x 2 x 4
.= 7200/- rupees

Total cost for 4 Window Frames & Window Shutters = 11200 + 7200 = 18,400/-

WALL PUTTY CALCULATIONS

Wall Putty :- (Available in a form of Powder or Paist provided on Walls and Ceilings).
Wall putty is provided on walls and ceiling to reduce the friction and to have smooth surface. it is provided in two coats and rub with San-paper. Thickness of wall putty layer .= 3mm. water is added to wall putty powder to make paste out of it, and paste will be pasted on walls. Standard weight of wall putty / m^3 = 849.0kgs
it is available in bags of 5kg, 10kg, 20kg and 40kgs

Problem-1 :-
Find no. of wall putty bag required and cost amount for the given details,
wall surface area = 1200 Ft^2
Ceiling area = 800 Ft^2
Rate/bag = 1200 rupees (for 40kg bag)
Also find labour charges if rate/ft^2 = 5.0/- rupees

Solution :-
1. Area of wall putty = wall surface area + ceiling area
.= 1200 + 800
.= 2000 Ft^2
.= 185.901 m^2

2. Thickness of wall putty layer = 3mm = 0.003m

3. Volume of wall putty = area of wall putty x thickness of wall putty
.= 185.901 x 0.003
.= 0.557 m^3

4. Standard weight of wall putty/m^3 = 849.0kgs

1.0m3 = 849.0kgs
0.557m3 = ? Kgs
.= 0.557 x 849
.= 472.893 kgs

5. No. of wall putty bags required = 472.893/40
.= 11.822 or approximately equal to 12 bags

6. Rate/bags = 1200/- rupees

7. Cost amount required = 1200 x 12 = 14400/- rupees.

8. Labour charges:-
Rate/Ft^2 = 5.0/- rupees
wall putty area = 2000 Ft^2

Total Labour charges = 5.0 x 2000 = 10,000/- rupees.

PAINT CALCULATIONS

Primer Paint :- (white wash)
Primer paint (white wash) is applied to plastered area before applying Emulsion paint to walls. so that the paint shall have required good looking view.

Standard :-
1.0 litre of Primer paint will cover 40.0 Ft^2 area

Problem-1 :-
For an Area of 6500.0Ft^2 (plastered surface area), Find how many litres of white Primer is required.
Solution :-
According to standard, 1.0 litre of Primer paint will cover 40.0 Ft^2 area.

40.0 Ft^2 = 1.0 litre
6500.0 Ft^2 = ? Litre
.= 6500 / 40
.= 162.5 litres

Each bucket of Primer paint is of 20.0 litre
Cost of each bucket = 3000/- rupees

No. of Primer Bucket required = required primer in litres / primer in each bucket
.= 162.5/20
.= 8.125 or approximately equal to 9 Primer Bucket required.

Cost amount required = Rate/bucket x no. of bucket
.= 3000 x 9
.= 27,000/- rupees

Emulsion and Enamel Paint :-

Types of Paints:
1. Emulsion Paint or Water Bond Paint--------- used for Plastering area
2. Enamel Paint or Oil Bond Paint ---------- used for Doors and Windows

Standards for Double coat of Paint:
1. 1.0 Litre of Emulsion paint will cover 4.2 m^2 area or 45 Ft^2 area
2. 1.0 Litre of Enamel paint will cover 4.5 m^2 area or 50 Ft^2 area

[a]. Price of External Emulsion paint is expensive, as it is expose to Sun rays but never get fade out, also expose to rain water but never get wash out. Emulsion paint will works as rain-coat to building.

[b]. Price of Internal paint is economical, as it is not expose to Sun-rays and Rain water.

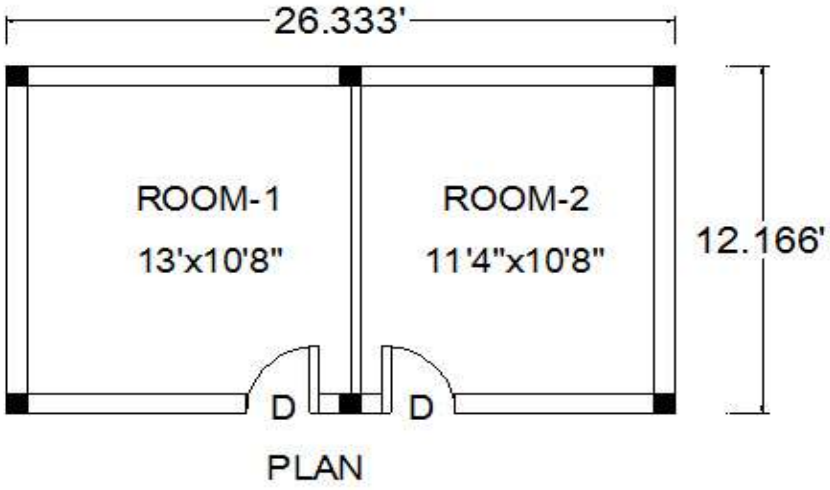
Problem-1 :-

From the given plan of two rooms find Internal Emulsion paint required & External Emulsion paint required in litres, and Enamel paint required in litres for Doors,

if thickness of Slab = 6" Height of Ceiling = 10'

Size of Door = 3'6" x 7' External wall thickness =9"

Internal wall thickness = 6"



PLAN

Solution :-

(i). Internal Emulsion paint :-

1. Ceiling area:

(a). Room-1 = L x B = 13' x 10'8"

.= 13' x 10.666'

.= 138.658 Ft^2

(b). Room-2 = L x B = 11'4" x 10'8"

.= 11.333' x 10.666'

.= 120.877 Ft^2

2. Wall surface area :-

(a). Room-1 = L x D = 47.332' x 10'

.= 473.32 Ft^2

D = Height of Ceiling = 10'

Peripheral length of wall 'L' = (L+B) x 2

.= (13' + 10.666') x 2

.= 47.332 Ft

(b). Room-2 = L x D = 43.998' x 10'
.= 439.98 Ft^2

D = Height of Ceiling = 10'
Peripheral length of wall 'L' = (L+B) x 2
.= (11.333' + 10.666') x 2
.= 43.998 Ft

3. Deduction of Door area = L x D x no.s
.= 3'6" x 7' x 2
.= 3.5' x 7' x 2
.= 49.0 Ft^2

4. Total internal paint area = 138.658 + 120.877 + 473.32 + 439.98 - 49.0 = 1123.835 Ft^2

According to Standards 1.0 litre of Emulsion paint will cover 45.0 Ft^2 area

45.0ft^2 = 1.0 litre
1123.835 Ft^2 = ? Litre
.= 1123.835 / 45
.= 24.974 or approximately equal to 25 litres

Rate/litre = 160/- rupees
Cost amount required = 160 x 25 = 4000/- rupees

(Ii). External Emulsion paint :-
1. External paint area = L x D
.= 76.998' x 10.5'
.= 808.479 Ft^2

External Peripheral length of wall 'L' = (L+B) x 2
.= (26.333' + 12.166') x 2
.= 76.998 Ft
D = Height of Ceiling = 10'
Slab thickness = 6" = 0.50'

2. Deduction of Door area = L x D x no.s
.= 3'6" x 7' x 2
.= 3.5' x 7' x 2
.= 49.0 Ft^2

3. Total External paint area = 808.479' - 49.0' = 759.479 Ft^2

According to Standards 1.0 litre of Emulsion paint will cover 45.0 Ft^2 area

$45.0ft^2$ = 1.0 litre
759.479 Ft^2 = ? Litre
.= 759.479 / 45
.= 16.877 or approximately equal to 17 litres

Rate/litre = 180/- rupees
Cost amount required = 180 x 17 = 3060/- rupees

(iii). Enamel paint for Doors :-
Size of Door = 3'6" x 7'
No. of Doors = 2
Enamel paint Area = L x D x 2 x no. of Doors
.= 3'6" x 7' x 2 x 2
.= 3.5' x 7' x 2 x 2
.= 98.0 Ft^2

According to Standards 1.0 litre of Enamel paint will cover 50.0 Ft^2 area

$50.0ft^2$ = 1.0 litre
98.0 Ft^2 = ? Litre
.= 98.0 / 50
.= 1.96 or approximately equal to 2 litres

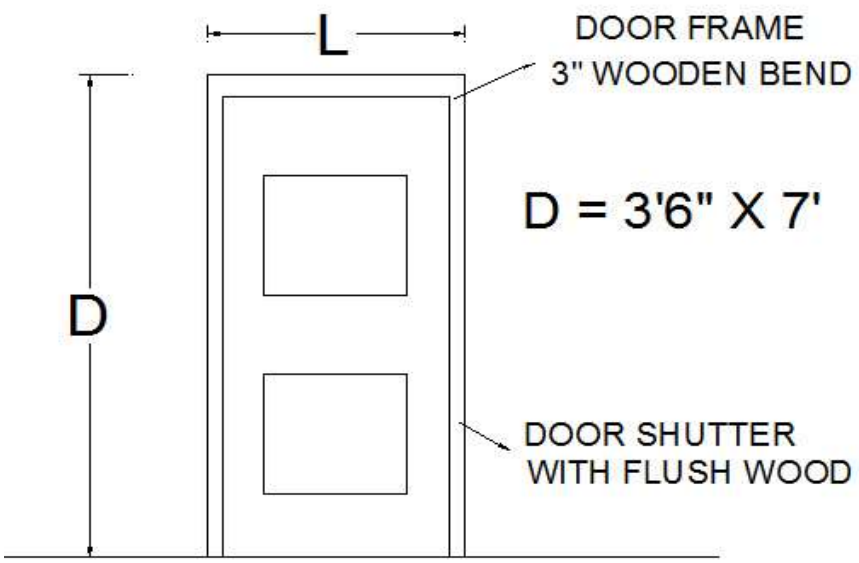
Rate/litre = 170/- rupees
Cost amount required = 170 x 2 = 340.0/- rupees

Note:-
To find area of Enamel paint for Doors, Front and back surface area of Door should be added, and side area shall not be added, because the oil paint or Enamel paint will be thick in nature, which will be harder to apply on the surface of Door. To make it thin, Turpentine (thinner) shall be added so that the paint brush will play softly.

Turpentine will make thick Enamel paint to thin Enamel paint, which increases the quantity of paint and this increased quantity of paint will cover internal and side area of Doors.

Surface Area of Door = L x D (front area) + L x D (back area)

.= L x D x 2

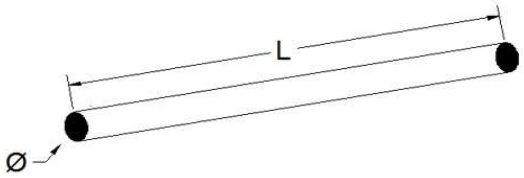


REINFORCEMENT CALCULATIONS

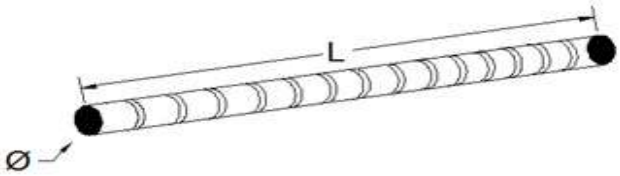
The dia for Steel bar or Reinforcement bar comes between 6mm to 40mm.
(Re-bars = Reinforcement bars = Steel-bars)

Types of Steel :

1. Mild- Steel (Plain steel bar)
Available dia of bar = 6mm and 8mm



2. Tor- Steel (Twisted steel bar which has anchorage on it)
Available dia of bar = 8mm, 10mm, 12mm, 16mm, 20mm up to 40mm



General Practice:
(i). The diameter of Steel bar used for Main and Distribution bars are above 8mm but in India for Slabs, Dia 8mm bar can be used.
(ii). The diameter of Steel bar used for Stirrups are 6mm and 8mm.

3. Meaning or Full form of equation:
(i). 12Ø16mm = 12 steel bars of diameter 16mm

(ii). Ø16mm@150mm = diameter of steel bar is 16mm at an spacing of 150mm (clear spacing)
(iii). Ø20mm@200mm c/c = diameter of steel bar is 20mm at an spacing of 200mm (centre to centre).

4. Types of Footing meshes commonly used :-

a. Plain Footing mesh

b. Mesh with hooks

c. Mesh with up-projection

d. Raft mesh

5. For G+2 or G+3 building, Diameter of Steel-Bar commonly used for the following :

a. Footings : Ø8mm and Ø10mm commonly used for Footing Meshes in India.

b. Columns : 6Ø12mm (main bars) and Ø8mm@100mm or 4"

c. Plinth Beams : 6Ø10mm (main bars) and Ø8mm@100mm or 4"

d. Floor Beams : 6Ø12mm (main bars) and Ø8mm@100mm or 4"

e. Floor Slab : Ø8mm@100mm or 4" or Ø10mm@100mm or 4" (mesh in both direction)

f. Stair-case : Waist slab mesh Ø10mm@100mm and Handrail mesh Ø8mm@100mm

g. water tank below ground level : Bottom & top slab mesh Ø8mm@100mm
Shear wall mesh : Ø10mm@100mm

h. Over head water tank on roof level : Bottom & top slab mesh Ø10mm@100mm
Shear wall mesh : Ø12mm@100mm

BAR BENDING SCHEDULE (B.B.S)

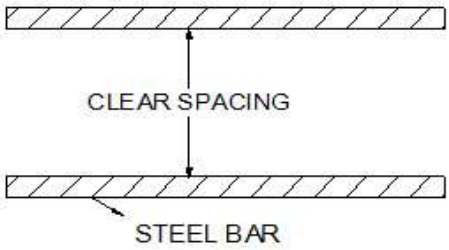
1. Standard length of each Steel bar all over the world = 12.0 m or 40 Ft.

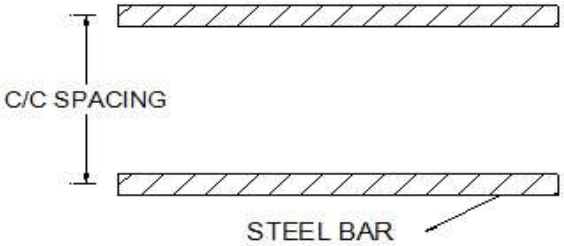
2. Spacing :-

The distance between two steel bar is called as Spacing

(i). Clear Spacing = The distance from face of steel bar to another face of Steel bar

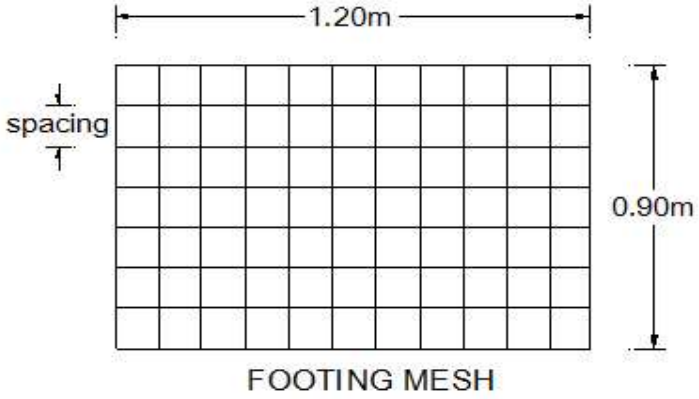
(ii). Centre to Centre Spacing = The distance from centre of steel bar to another centre of steel bar





3. No. of bars = (opposite length / spacing) + 1

Problem-1 ;- Find no. of x-bars and y-bars with spacing 0.10m for a given footing mesh

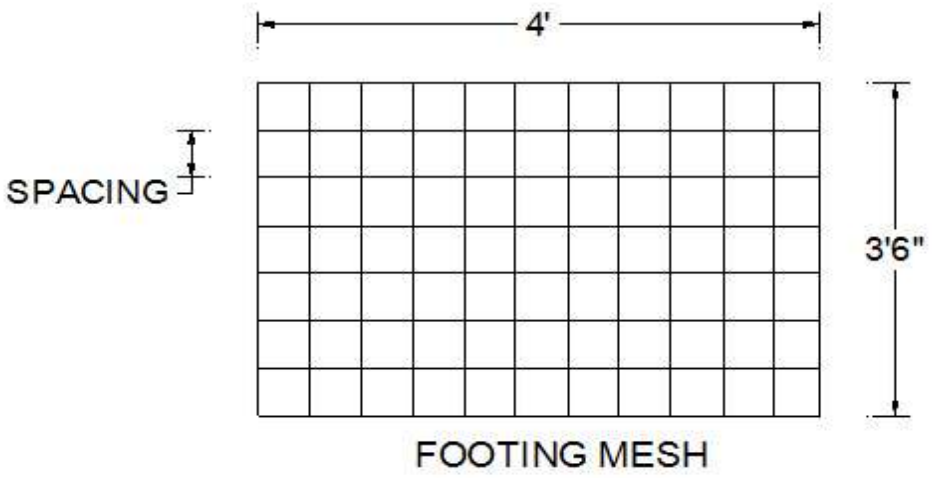


Solution : The Steel bars provided in x-direction is called as x-bars and
The Steel bars provided in y-direction is called as y-bars

(i). No. of x-bars = (opposite length / spacing) + 1
.= (0.90 / 0.10) + 1
.= 10 bars in x-direction

(Ii). No. of y-bars = (opposite length / spacing) + 1
.= (1.2 / 0.10) + 1
.= 13 bars in y-direction

Problem-2 ;- Find no. of x-bars and y-bars with spacing 4 inch for a given footing mesh



FOOTING MESH

Solution : The Steel bars provided in x-direction is called as x-bars and
The Steel bars provided in y-direction is called as y-bars

(i). No. of x-bars = (opposite length / spacing) + 1
.= (42" / 4") + 1
.= 11.5 bars
.= approximately equal to 12 bars in x-direction

3.5'= ? Inches
Since 1' = 12"
.= 3.5 x 12
.= 42"

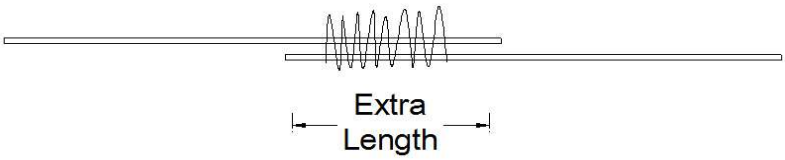
(Ii). No. of y-bars = (opposite length / spacing) + 1
.= (48" / 4") + 1
.= 13 bars in y-direction

4' = ? Inches
Since 1' = 12"
.= 4 x 12
.= 48"

4. Over-lap length :-

Each over-lap length = 50d (Practically)
where d = dia of bar
(over-lap length means Joining to steel bar with extra length of Steel bar)

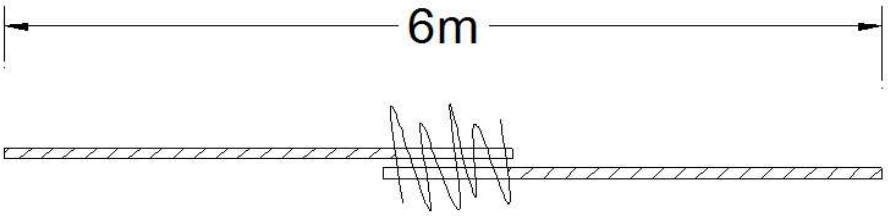
Extra Length = Over-lap Length



Theoretical Standards for Over-lap length:-
1. For Compressive member (vertical member) Standard over-lap length = 40d
(Vertical over-lap)

2. For Tensile member (Horizontal member) Standard over-lap length = 50d
(Horizontal over-lap)

Problem -1 :- Find length of steel bars including over-lap length from the given figure
if dia of bars are:- 12mm, 16mm and 20mm

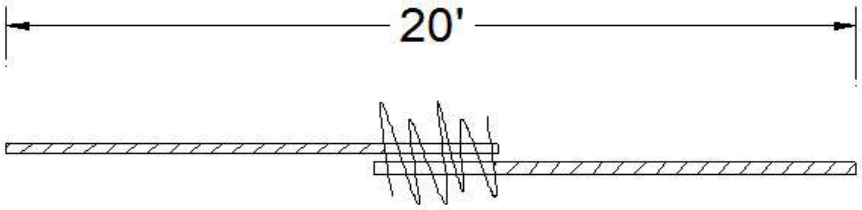


Solution:- Length of steel bar = Total length + over-lap length
Length of steel bar = L + 50D

1. Length of bar, if dia of bar = 12mm = L + 50D = 6.0m + 50 x 0.012m = 6.60m
2. Length of bar, if dia of bar = 16mm = L + 50D = 6.0m + 50 x 0.016m = 6.80m
3. Length of bar, if dia of bar = 20mm = L + 50D = 6.0m + 50 x 0.020m = 7.00m

12mm = ? m	16mm = ? m	20mm = ? m
Since 1m = 1000mm	Since 1m = 1000mm	Since 1m = 1000mm
.= 12/1000	.= 16/1000	.= 20/1000
.= 0.012m	.= 0.016m	.= 0.020m

Problem -2 :- Find length of steel bars including over-lap length from the given figure
if dia of bars are:- 12mm, 16mm and 20mm

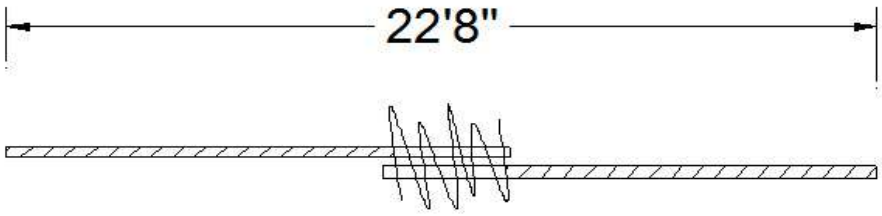


Solution:- Length of steel bar = Total length + over-lap length
Length of steel bar = L + 50D

12mm = ? Ft	0.472" = ? Ft
Since 1" = 25.4mm	Since 1ft = 12"
.=12/25.4	.= 0.472/12
.=0.472"	.= 0.0393 Ft

1. Length of bar, if dia of bar = 12mm = L + 50D = 20' + 50 x 0.0393' = 21.965 Ft
2. Length of bar, if dia of bar = 16mm = L + 50D = 20' + 50 x 0.0524' = 22.62 Ft
3. Length of bar, if dia of bar = 20mm = L + 50D = 20' + 50 x 0.0656' = 23.28 Ft

Problem -3 :- Find length of steel bars including over-lap length from the given figure
if dia of bars are:- 12mm, 16mm and 20mm



Solution:- Length of steel bar = Total length + over-lap length
Length of steel bar = L + 50D

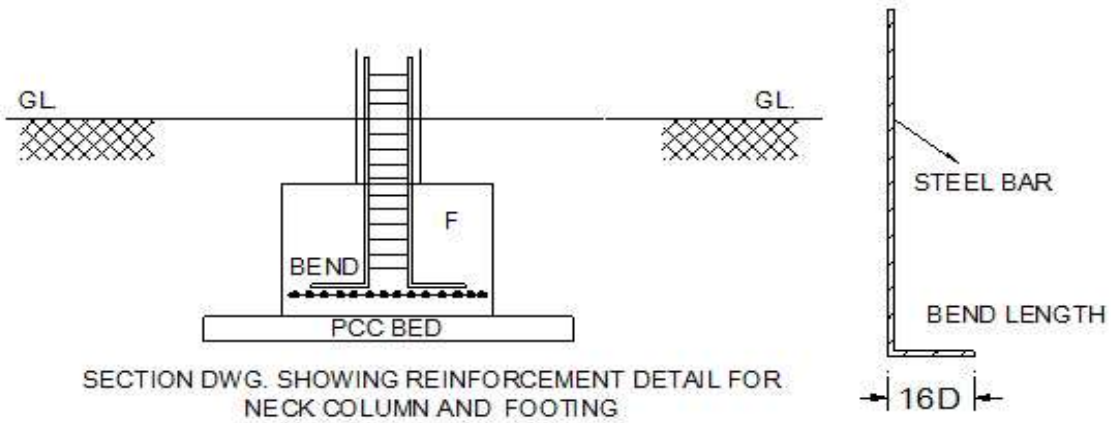
8" = ? Ft	12mm = ? Ft	0.472" = ? Ft
Since 1ft = 12"	Since 1" = 25.4mm	Since 1ft = 12"
.= 8/12	.=12/25.4	.= 0.472/12
.= 0.666 Ft	.=0.472"	.= 0.0393 Ft

1. Length of bar, if dia of bar = 12mm = L + 50D = 22.666' + 50 x 0.0393' = 24.631 Ft
2. Length of bar, if dia of bar = 16mm = L + 50D = 22.666' + 50 x 0.0524' = 25.286 Ft
3. Length of bar, if dia of bar = 20mm = L + 50D = 22.666' + 50 x 0.0656' = 25.946 Ft

5. Bend Length :-

Each Bend length = 16d (Practically)

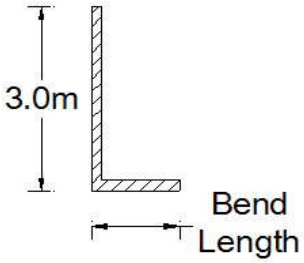
where d = dia of bar



SECTION DWG. SHOWING REINFORCEMENT DETAIL FOR NECK COLUMN AND FOOTING

Problem -1 :-

Find length of steel bars including Bend length from given the figure if dia of bars are:- 12mm, 16mm and 20mm



Solution:- Length of steel bar = Total length + Bend length

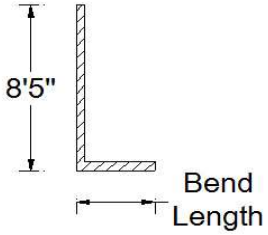
Length of steel bar = L + 16D

12mm = ? M	16mm = ? M	20mm = ? M
Since 1.0m = 1000mm	Since 1.0m=1000mm	Since 1m = 1000mm
.= 12/1000	.= 16/1000	.= 20/1000
.= 0.012m	.= 0.016m	.= 0.020m

1. Length of bar, if dia of bar = 12mm = L + 16D = 3.0 + 16 x 0.012 = 3.192m
2. Length of bar, if dia of bar = 16mm = L + 16D = 3.0 + 16 x 0.016 = 3.256m
3. Length of bar, if dia of bar = 20mm = L + 16D = 3.0 + 16 x 0.020 = 3.32m

Problem -2 :-

Find length of steel bars including Bend length from the given figure if dia of bars are:- 12mm, 16mm and 20mm



Solution:- Length of steel bar = Total length + Bend length

Length of steel bar = L + 16D

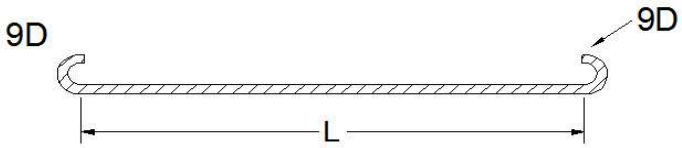
5" = ? Ft	12mm = ? Ft	0.472" = ? Ft
Since 1ft = 12"	Since 1" = 25.4mm	Since 1ft = 12"
.= 5/12	.=12/25.4	.= 0.472/12
.= 0.416 Ft	.=0.472"	.= 0.0393 Ft

1. Length of bar, if dia of bar = 12mm = L + 16D = 8.416' + 16 x 0.0393' = 9.044 Ft
2. Length of bar, if dia of bar = 16mm = L + 16D = 8.416' + 16 x 0.0524' = 9.254 Ft
3. Length of bar, if dia of bar = 20mm = L + 16D = 8.416' + 16 x 0.0656' = 9.465 Ft

6. Hook Length :-

Each Hook length = 9D

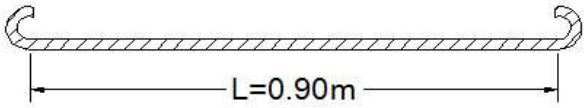
where d = dia of bar



Total length of steel bar including Hook lengths = L + 9D + 9D

.= L + 18D

Problem -1 :- Find length of steel bars including Hook length from the given figure if dia of bars are:- 6mm, 8mm and 10mm



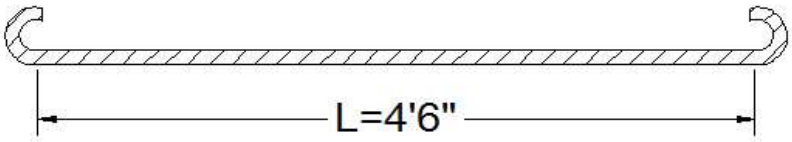
Solution:- Length of steel bar = Total length + Bend length

Length of steel bar = L + 18D

6mm = ? M	8mm = ? M	10mm = ? M
Since 1.0m = 1000mm	Since 1.0m = 1000mm	Since 1.0m = 1000mm
.= 6/1000	.= 8/1000	.= 10/1000
.= 0.006m	.= 0.008m	.= 0.010m

1. Length of bar, if dia of bar = 6mm = L + 18D = 0.90 + 18 x 0.006 = 1.008m
2. Length of bar, if dia of bar = 8mm = L + 18D = 0.90 + 18 x 0.008 = 1.044m
3. Length of bar, if dia of bar = 10mm = L + 18D = 0.90 + 18 x 0.010 = 1.080m

Problem -2 :- Find length of steel bars including Hook length from the given figure if dia of bars are:- 6mm, 8mm and 10mm



Solution:- Length of steel bar = Total length + Bend length

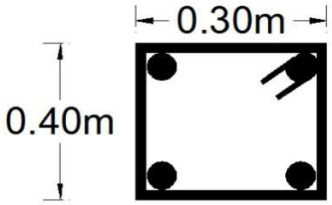
Length of steel bar = L + 18D

6mm = ? Inch	0.236" = ? Ft	6" = ? Ft
Since 1" = 25.4mm	Since 1 Ft = 12"	Since 1 Ft = 12"
.= 6/25.4	.= 0.236/12	.= 6/12
.= 0.236"	.= 0.0196 Ft	.= 0.50 Ft

1. Length of bar, if dia of bar = 6mm = L + 18D = 4.5' + 18 x0.0196' = 4.852'
2. Length of bar, if dia of bar = 8mm = L + 18D = 4.5' + 18 x 0.0262 = 4.971'
3. Length of bar, if dia of bar = 10mm = L + 18D = 4.5' + 18 x 0.0328 = 5.090'

Problem-3 :-

Find length of Stirrup from the given figure if dia of Stirrup = 6mm and 8mm



Solution :- Ø = 6mm & 8mm for Stirrup or Tie

(i). Length of Stirrup or tie = L + 18D where 'L' .= (L + B) x 2

.= 1.40 + 18 x 0 .006 .= (0.30+0.40) x 2

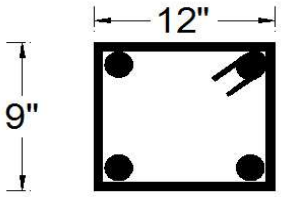
.= 1.508m .= 1.40m

6mm = ? M	8mm = ? M
Since 1.0m= 1000mm	Since 1.0m= 1000mm
.= 6/1000	.= 8/1000
.= 0.006m	.= 0.008m

(ii). Length of Stirrup or tie = L + 18D where 'L' .= (L + B) x 2
.= 1.40 + 18 x 0.008 .= (0.30+0.40) x 2
.= 1.544m .= 1.40m

Problem-4 :-

Find length of Stirrup from the given figure
if dia of Stirrup = 6mm and 8mm



Solution :- Given Ø = 6mm & 8mm for Stirrup or Tie

6mm = ? inch
Since 1" = 25.4mm
.= 6/25.4
.= 0.236"

8mm = ? inch
Since 1" = 25.4mm
.= 8/25.4
.= 0.314"

(i). Length of Stirrup or tie = L + 18D where 'L' .= (L + B) x 2
.= 42" + 18 x 0.236" .= (9" + 12") x 2
.= 46.248" .= 42"
.= 46.248/12
.= 3.854 Ft

(ii). Length of Stirrup or tie = L + 18D where 'L' .= (L + B) x 2
.= 42" + 18 x 0.314" .= (9" + 12") x 2
.= 47.652" .= 42"
.= 47.652/12
.= 3.971 Ft

7. Concrete Cover:-

The gap or distance between Steel bar and shuttering is called as Concrete Cover. Concrete Cover is provided in concrete to give strength to the concrete and to safe reinforcement from atmospheric temperature, Rain water and Rust (Corrosion).

Condition:-

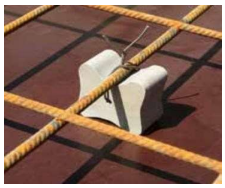
(i). If the length or width of item is less than or equal to 0.3m or 12" then cover=25mm or 1"

(ii). If the length or width of item is between 0.4m to 0.5m or 16" to 20" then cover=50mm or 2"

(iii).If the length or width of item is greater than or equal to 0.6m or 24" then cover=100mmor 4"

Types of Covering block :-

(1). Steel covering block (2). Wooden block (3). C:M block (4). PVC block (5). Piece of Stones

Problem -1 :-

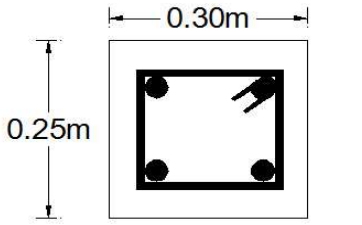
From the given figure find

(i). Length of Stirrups

(ii). No. of Stirrups

if Height of Column = 2.70m ; spacing = 0.10m

dia of stirrup = 8mm



PLAN OF COLUMN

Solution :-

(i). According to condition, deduction of Concrete Cover from four sides of Column

if Length or width of item is less than or equal to 0.30m then cover = 1"=25mm = 0.025m

L = 0.30 - 0.025 - 0.025 = 0.25m

B = 0.25 - 0.025 - 0.025 = 0.20m

L = (L+B) x 2

L = (0.25 + 0.20) x 2 = 0.90m

Length of Tie or Stirrup = L + 18D

.= 0.90 + 18 x 0.008

.= 1.044m

(ii). No. of Stirrups = (Height of Column / spacing) + 1

.= (2.7 / 0.10) + 1

.= 28 ties or stirrups

Problem -2 :-

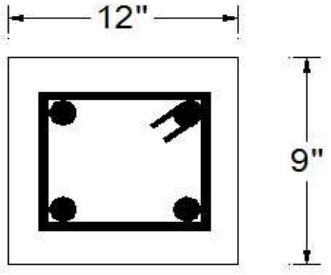
From the given figure find

(i). Length of Stirrups

(ii). No. of Stirrups

if Height of Column = 9 Ft ; spacing = 4"

dia of stirrup = 8mm



PLAN OF COLUMN

Solution :-

(i). According to condition, deduction of Concrete Cover from four sides of Column

if Length or width of item is less than or equal to 1.0 Ft then cover = 1" = 25mm = 0.025m

L = 12" - 1" - 1" = 10"

B = 9" - 1" - 1" = 7"

L = (L+B) x 2

L = (10" + 7") x 2 = 34"

Length of Tie or Stirrup = L + 18D

.= 34" + 18 x 0.314

.= 39.652"

.= 39.652 / 12

.= 3.304 Ft

8mm = ? Inch

Since 1" = 25.4mm

.= 8/25.4

.= 0.314"

4" = ? Ft

Since 1' = 12"

.= 4/12

.= 0.333 Ft

(ii). No. of Stirrups = (Height of Column / spacing) + 1

.= (9' / 0.333) + 1

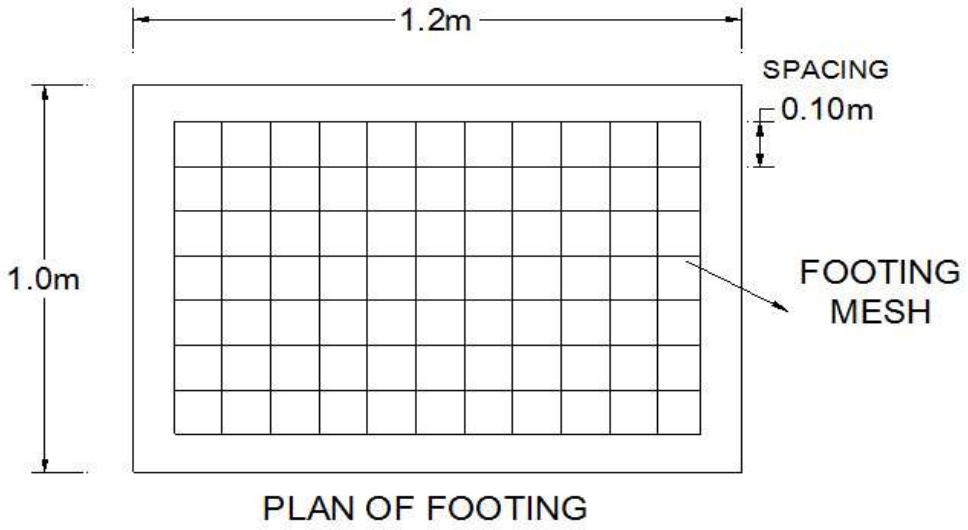
.= 28.02 ties or stirrups

.= approximately equal to 28 ties

Problem -3 :- From the given figure find

(i). Length of x-bar and y-bar (ii). No. of x-bar and y-bar

if spacing = 0.10m



PLAN OF FOOTING

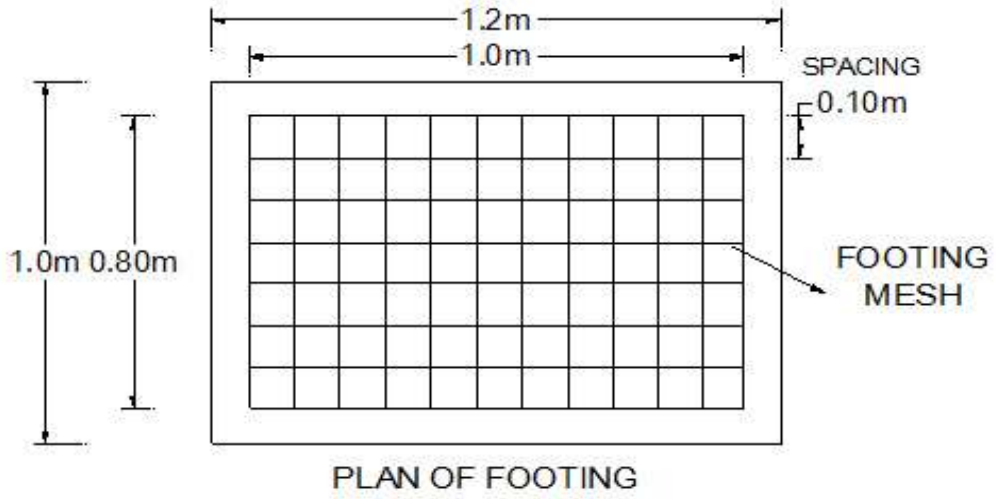
Solution :-

(i). According to condition, deduction of Concrete Cover from four sides of footing

if Length or width of item is less than or equal to 0.60m then cover = 4"=100mm = 0.10m

1. Length of x-bar = 1.20 - 0.10 - 0.10 = 1.0m

2. Length of y-bar =1.0 - 0.10 - 0.10 = 0.80m



PLAN OF FOOTING

(ii). No. of x and y bars

(a). No. of x-bar = (opposite length /spacing) + 1

.= (0.80/0.10) +1

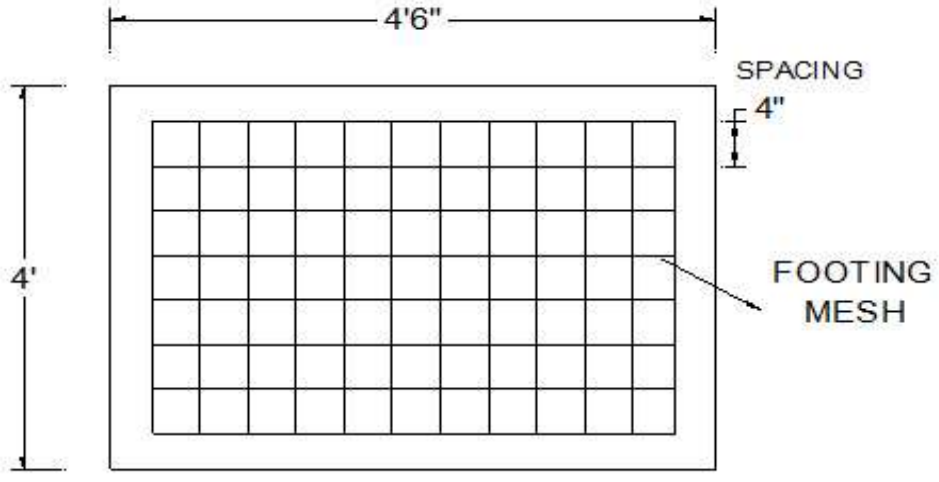
.= 9 bars

(b). No. of y-bar = (opposite length /spacing) + 1

.= (1.0/0.10) +1

.= 11 bars

Problem -4 :-



PLAN OF FOOTING

From the given figure find

(i). Length of x-bar and y-bar

(ii). No. of x-bar and y-bar

if spacing = 4"

Solution :-

(i). According to condition, deduction of Concrete Cover from four sides of footing

if Length or width of item is less than or equal to 0.60m then cover = 4" = 100mm=0.10m

1. Length of x-bar = 4'6" - 4" -4" = 3'10"

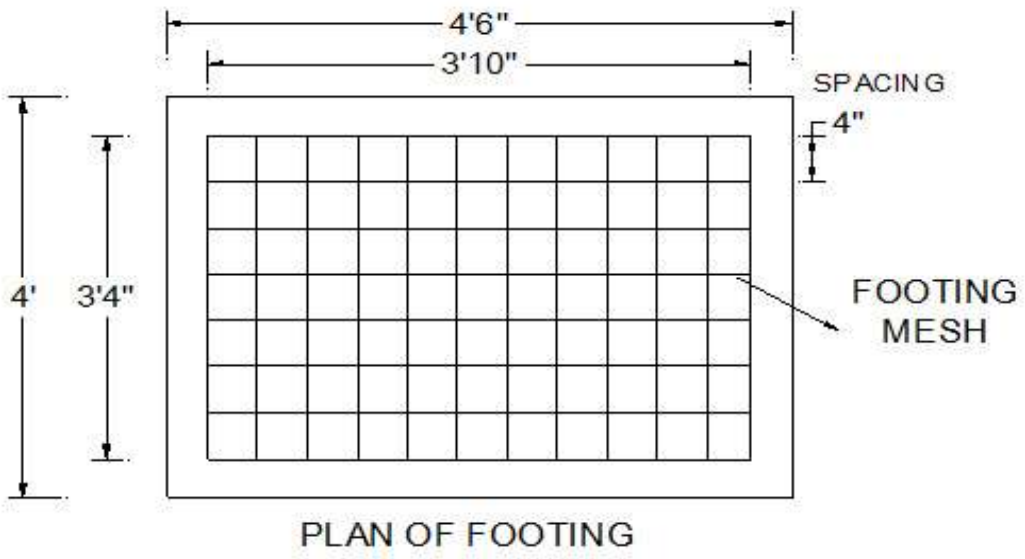
2. Length of y-bar =4' - 4" - 4" = 3'4"

(ii). No. of x and y bars

(a). No. of x-bar = (opposite length /spacing) + 1

.= (40"/4") +1

.= 11 bars



PLAN OF FOOTING

(b). No. of y-bar = (opposite length /spacing) + 1

.= (46"/4") +1

.= 12.5 bars

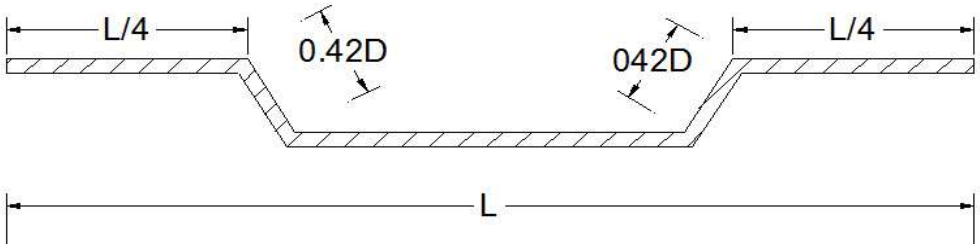
.= approximately equal to 13 bars

8. Crank Bar :-

each crank length = 0.42D

where D = Depth of Slab or Beam - Top & Bottom cover

Mostly Cranking is done in Slab and Beams.



Length of Crank bar = L + 0.42D + 0.42D

.= L + 0.84D

where D = Depth of Slab or Beam - Top & Bottom cover

There are three types of bars :-

(i). Straight Bar : Steel bar which is linear (straight) in length is called as straight bar.

(ii). Crank Bar : Steel bar which is bent up at an angle of 45 degree is called as Crank bar.

(iii). Extra Bar : Steel bar which is provide under each crank is called as Extra bar.

Conditions for providing Crank bar:-

(1). If the span between two columns supporting the Slab is less than or equal to 4.0 m or 12 Ft then straight bar is enough to carry the load of Slab.

(2). If the span between two columns supporting the Slab is greater than 4.0 m or 12 Ft then Crank bar is provided in the Slab to balance the load and stresses developing at the corner of Slab. Cranking should be done at a distance of L/4 from corner of Slab.

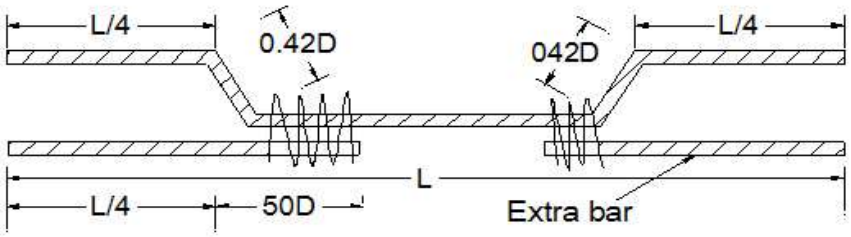
9. Extra bar

The length of each Extra bar = (L/4) + 50D

where D = dia of bar; L = length of Crank bar including crank length

L/4 is 1/4th length of slab

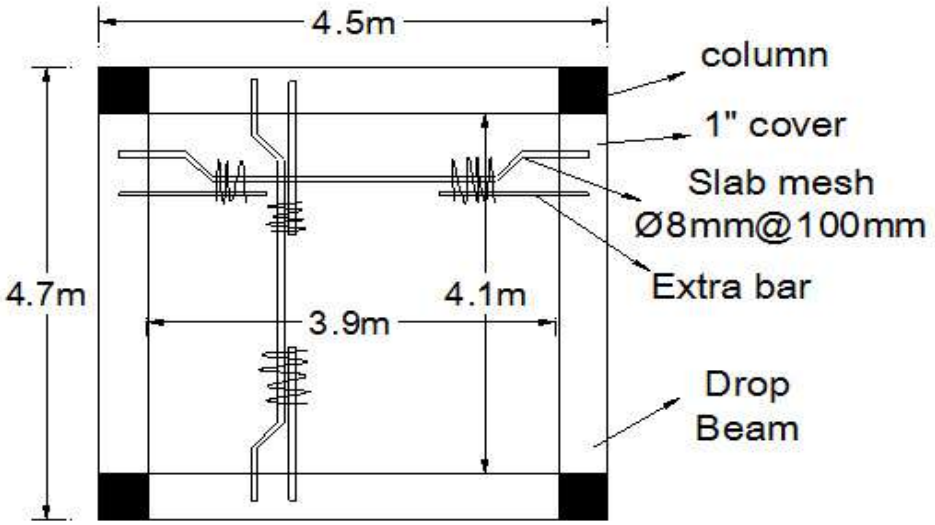
50D is over-lap length



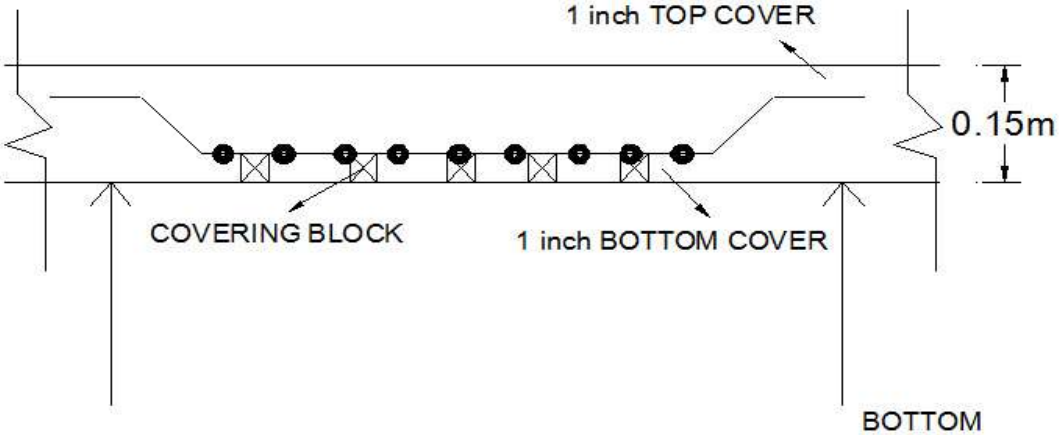
Problem-1 :- From the given figure find,

(i). Length of x-bar and y-bar; (ii). No. of x-bars and y-bars

(iii). Length of Extra bar in x & y-direction ; (iv). No. of Extra bar



PLAN OF TWO WAY SLAB



SECTION DWG. OF TWO WAY SLAB

Solution :-

According to conditions, 1 inch concrete cover shall be deducted from four sides of Slab

(i). Length of x-bar and y-bar 1" = 25mm = 0.025m

(a). Length of x-bar = length of slab + crank length - concrete cover from both side of slab

.= L + 0.42D + 0.42D - 1" - 1"

.= L + 0.84D - 0.025 - 0.025

.= 4.5m + 0.84D - 0.025m - 0.025m

.= 4.5 + 0.84 x 0.10 - 0.025 - 0.025

.= 4.534m

D = Depth of Slab - top cover - bottom cover

D = 0.15 -0.025 - 0.025

D = 0.10m

1" = 25mm = 0.025m

(b).Length of y-bar = breadth of slab + crank length - concrete cover from both side of slab

.= L + 0.42D + 0.42D - 1" - 1"

.= L + 0.84D - 0.025 - 0.025

.= 4.7m + 0.84D - 0.025m - 0.025m

.= 4.7 + 0.84 x 0.10 - 0.025 - 0.025

.= 4.734m

D = Depth of Slab - top cover - bottom cover

D = 0.15 -0.025 - 0.025

D = 0.10m

(ii). No. of x-bar and y-bars Given spacing = 100mm = 0.10m

(a). No. of x-bars = (opposite length / spacing) + 1

.= (4.1/0.1) + 1

.= 42 bars

(b). No. of y-bars = (opposite length / spacing) + 1

.= (3.9/0.1) + 1

.= 40 bars

(iii). Length of Extra-bar in x and y direction

(a). The length of each Extra bar in x-direction = (L/4) + 50D

where D = dia of bar; L = length of Crank bar including crank length

Given dia of bar = 8mm = 0.008m .= (4.534/4) + 50 x 0.008

.= 1.533m

(b). The length of each Extra bar in y-direction = (L/4) + 50D

where D = dia of bar; L = length of Crank bar including crank length

Given dia of bar = 8mm = 0.008m .= (4.734/4) + 50 x 0.008

.= 1.583m

(iv). No. of Extra-bars in x and y-direction

(a). No. of Extra-bar in x-direction = no. of x-bars x 2

.= 42 x 2 = 84 bars

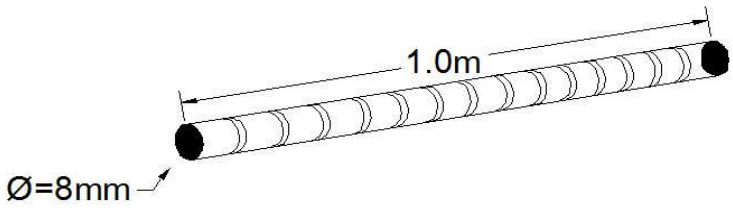
(b). No. of Extra-bar in y-direction = no. of y-bars x 2

.= 40 x 2 = 80 bars

WEIGHT OF STEEL BAR CALCULATIONS

(a). Density of Steel = 7850 kgs/m^3

(b). Density of Steel = 0.00785 kgs/mm^3



Formulas :-

There are four formulas to find weight of Steel bar in kgs/m, which ever is convenient, can be used.

1. Weight of Steel bar in kgs / m .= Area of Steel bar x Density of Steel

where d = dia of bar in mm .= π/4 x d^2 x Density of Steel

If dia = 8mm

Weight of Steel bar in kgs / m .= π/4 x 8^2 x 0.00785

.= 0.39 kgs/m

2. Weight of Steel bar in kgs / m = Volume of Steel bar x Density of Steel

where d = dia of bar in metres .= Area of Steel bar x length of bar x Density of Steel

.= π/4 x d^2 x L x Density of Steel

If dia = 8mm .= π/4 x d^2 x L x Density of Steel

Weight of Steel bar in kgs / m .= π/4 x 0.008^2 x 1.0 x 7850

.= 0.39 kgs/m

3. According to Thumb Rule :-

Weight of Steel bar in kgs / m .= $d^2/162$

where d = dia of bar in mm

and 162 is constant value

If dia = 8mm

Weight of Steel bar in kgs / m .= $8^2/162$

.= 0.39 kgs/m

4. According to Mohammed Haroon's Rule :-

Weight of Steel bar in kgs / m .= Area of Steel bar / 127

where d = dia of bar in mm .= ($\pi/4$ x d^2) / 127

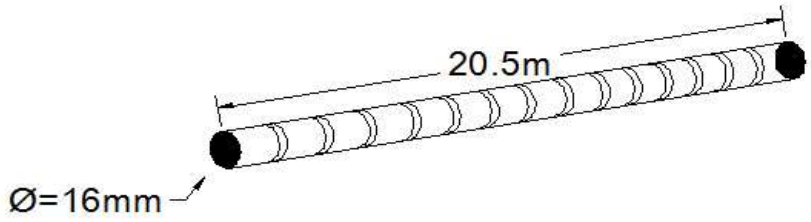
If dia = 8mm

Weight of Steel bar in kgs / m .= ($\pi/4$ x 8^2) / 127

.= 0.39 kgs/m

Problem -1 :-

Find weight of Steel bar from given diagram



Solution :-

According to Thumb Rule :-

Weight of Steel bar in kgs / m .= $d^2/162$

where d = dia of bar in mm

and 162 is constant value

If dia = 16mm

Weight of Steel bar in kgs / m .= $16^2/162$

.= 1.58 kgs/m

Given length of bar = 20.5m

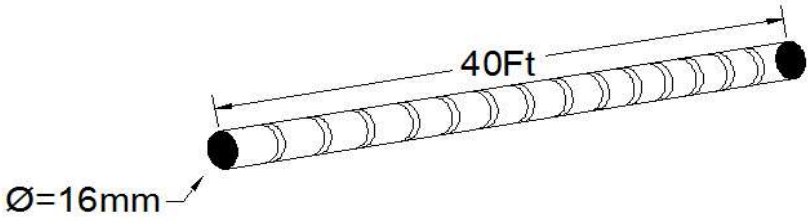
weight of steel bar = weight of steel bar/m x length of bar

.= 1.58 x 20.5

.= 32.39 kgs

Problem -2 :-

Find weight of Steel bar from given diagram



Solution :-

According to Thumb Rule :-

Weight of Steel bar in kgs / m .= $d^2/162$

where d = dia of bar in mm .= $16^2/162$

and 162 is constant value .= 1.58 kgs/m

Weight of Steel bar in kgs / Ft .= $d^2/531.36$

Since 1.0m = 3.28Ft .= 16^2 /531.36

162 x 3.28 = 531.36 .= 0.481 kgs/Ft

or 0.481 x 3.28 = 1.58 kgs/m

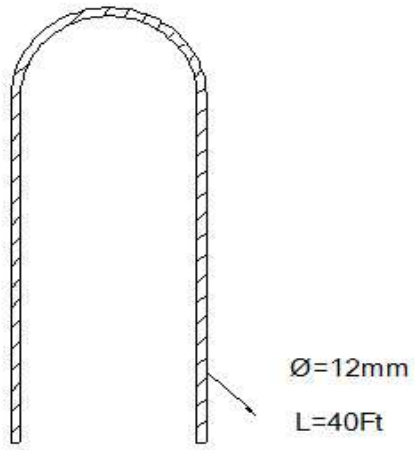
Given length of steel bar = 40Ft

Weight of Steel bar = Weight / Ft x length of steel bar

.= 0.481 x 40

.= 19.24 kgs

Problem -3 : On a site about 55 no. of Steel bars of dia 12mm have been unloaded from Truck, Find (i). weight of Steel bars and (ii). Required amount to pay the bill, if Rate of Steel/kg = 48.0 rupees.



Solution :-

Note: Standard length of Steel bar all over the world = 12.0m or 40 Ft.

Given dia of bar = 12mm ; Standard length of each bar = 40 Ft

Weight of Steel bar in kgs / Ft $.= d^2/531.36$

$.= 12^2/531.36$

$.= 0.27$ kgs/Ft

(i). Weight of Steel bar = Weight / Ft x length of steel bar x no. of bars

.= 0.27 x 40 x 55

.= 594.0 kgs

(ii). Amount required = weight of steel bars in kgs x Rate / kgs

.= 594.0 x 48

.= 28,512.0 rupees

Problem -4 :-

For a given plan of footing find

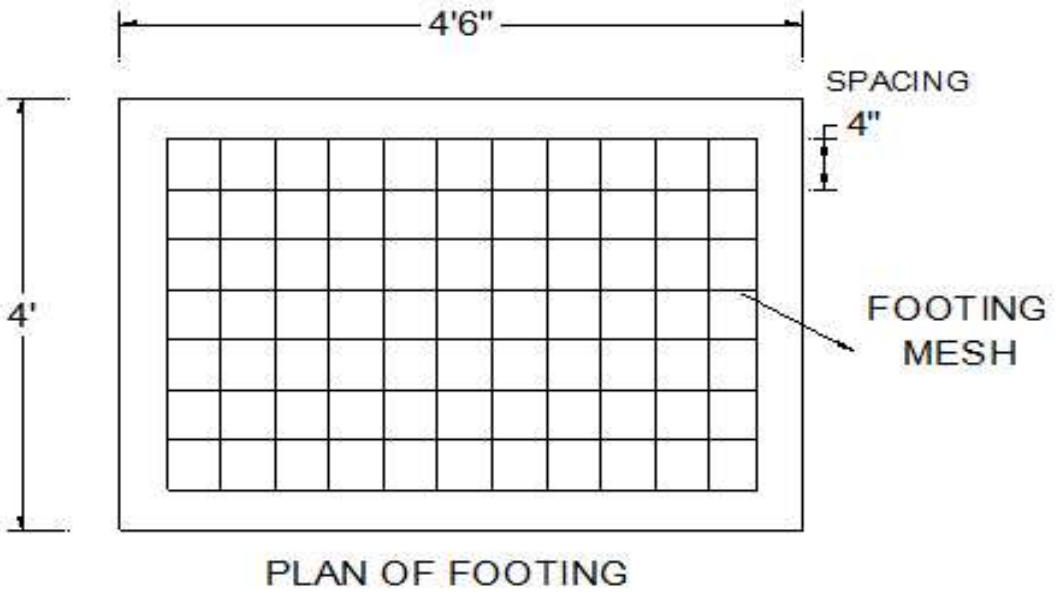
(i). Weight of Steel required for making plain footing meshes if, spacing = 4"

Footing mesh details: 11Ø12mm in x-direction; 13Ø16mm in y-direction

and no. of footings = 12

(ii). No. of Steel bars required, of length 40Ft

(iii). Bill of Quantities for Footing Reinforcement if Rate of steel /kg = 48.0 rupees.



PLAN OF FOOTING

Solution :-

According to condition, deduction of Concrete Cover from four sides of Footing

if Length or width of item is greater than or equal to 0.60m then cover = 4" = 100mm

(i). x-bar calculation:- = 0.10m

1. Length of x-bar = 4'6" - 4" - 4" = 3'10"
2. No. of x-bars = 11
3. Total length of x-bar = 11 x 3'10" (no. of x-bars X length of each x-bar)

.= 11' x 3.833

.= 42.163Ft

4. Given dia of x-bar = 12mm:
5. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 12^2 /531.36

.= 0.27 kgs/Ft

6. Total weight of Steel required = weight/Ft x Total length of x-bar x no. of footings

.= 0.27 x 42.163 x 12

.= 136.608 kgs steel required of Ø12mm

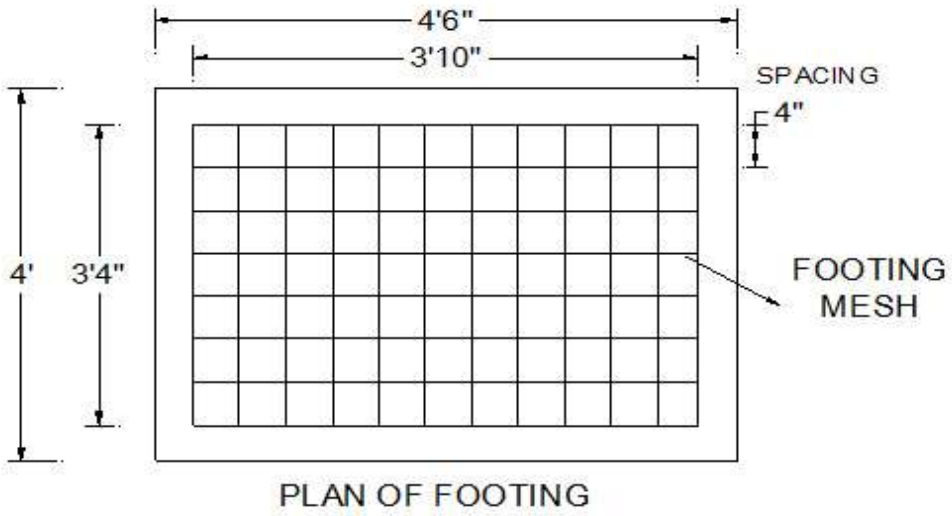
(ii). y-bar calculation:-

1. Length of y-bar =4' - 4" - 4" = 3'4"
2. No. of y-bars = 13
3. Total length of y-bar .= no. of y-bars x length of each y-bar

.= 13 x 3'4"

.= 13' x 3.333

.= 43.329Ft



PLAN OF FOOTING

4. Given dia of y-bar = 16mm

5. Weight of Steel bar in kgs / Ft. $= d^2/531.36$
$= 16^2/531.36$
$= 0.481$ kgs/Ft

6. Total weight of Steel required = weight/Ft x Total length of y-bar x no. of footings
$= 0.481 \times 43.329 \times 12$
= 250.094 kgs steel required of Ø16mm

(iii). Total weight of steel required for 12 footing meshes of Ø12mm & Ø16mm

weight of x-bars required = 136.608 kgs for Ø12mm

weight of y-bars required = 250.094 kgs for Ø16mm

(iv). No. of Steel bars required of length 40Ft.

(a). Ø12mm

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar for x-bar = 12mm

3. Weight of Steel bar in kgs / Ft $= d^2/531.36$
$= 12^2/531.36$
$= 0.27$ kgs/Ft

4. weight of each steel bar of length 40' = 0.27 x 40 = 10.8 kgs

5. No. of Steel bars of length 40' required = weight of steel required / weight of each steel bar of Ø12mm
$= 136.608 / 10.8$
= 12.648 or approximately equal to 13 bars of Ø12mm required.

For 12.648 steel bars the required weight of steel = 136.608 (required weight of steel)

For 13 Steel bars the required weight of steel = 10.8 x 13 = 140.4 kgs (Actual weight of steel)

(b). Ø16mm

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar for y-bar = 16mm

3. Weight of Steel bar in kgs / Ft $= d^2/531.36$
$= 16^2/531.36$
$= 0.481$ kgs/Ft

4. weight of each steel bar of length 40' = 0.481 x 40 = 19.24kgs

5. No. of Steel bars of length 40' required = wt. of steel required /wt. of each Steel bar of Ø12mm .= 250.094 / 19.24
.= 12.998 or approximately equal to 13 bars of Ø16mm required.

For 12.998 steel bars the required weight of steel = 250.094 (required weight of steel)
For 13 Steel bars the required wt of steel = 19.24 x 13 = 250.12 kgs (Actual wt. of steel)

(iv). Bill of Quantities for Footing reinforcement:-

BILLL OF QUANTITES FOR FOOTING REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø12mm	Kgs	48.00	140.400	13	6739.200	
2	Ø16mm	Kgs	48.00	250.120	13	12005.760	
					Total	18744.960	
				Add 10% wastage		1874.496	
			Add 5% Contingencies			937.248	
					Total	21556.704	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-2:-

For a given plan of footing find

(i). Weight of Steel required for making footing meshes with hooks

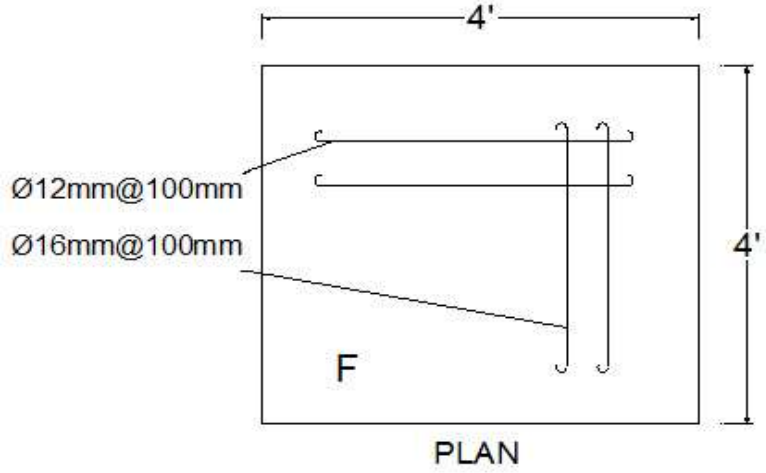
(ii). No. of Steel bars required, of length 40Ft

(iii). Bill of Quantities for Footing Reinforcement

Footing mesh details:

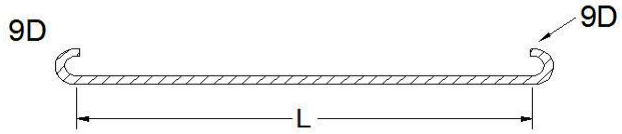
Ø12mm@100mm or 4" in x-direction and Ø16mm@100mm or 4" in y-direction

no. of footings = 8 spacing = 4" and Rate of steel/kg = 48.0 rupees.



Solution :-

(i). x-bar calculation:-



Total length of bar .= L + 9D + 9D

.= L + 18D

where D= dia of bar

According to condition, deduction of Concrete Cover from four sides of Footing

if Length or width of item is greater than or equal to 0.60m or 2' then cover=4"=100mm

" L" = 4' - 4" - 4" = 3'4" = 3.333'

dia of x-bar = 12mm = 0.0393'

1. Length of x-bar = L + 18D

.= 3.333' + 18 x 0.0393'

.= 4.04'

12mm=? Ft

since 1"=25.4mm

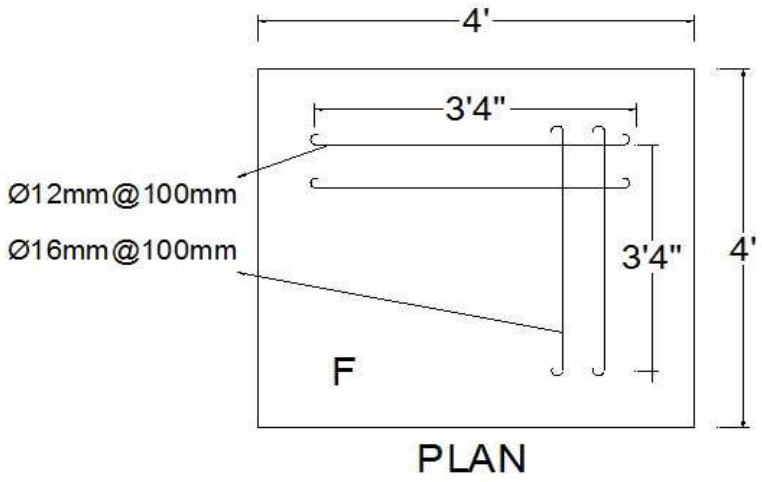
.=12/25.4

.= 0.472" = ? Ft

since 1ft = 12"

.= 0.472/12

.= 0.0393ft



2. No. of x-bar = (opposite length /spacing) + 1

.= (40"/4") +1

.= 11 bars

3. Total length of x-bar = no. of x-bars x length of each x-bar

.= 11 x 4.04'

.= 44.44'

4. Given dia of x-bar = 12mm

5. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 12^2 /531.36

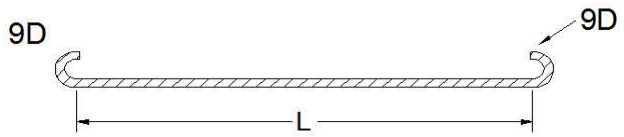
.= 0.27 kgs/Ft

6. Total weight of Steel required = weight/Ft x Total length of x-bar x no. of footings

.= 0.27 x 44.44 x 8

.= 95.99 kgs steel required of Ø12mm

(ii). y-bar calculation:-



Total length of bar .= L + 9D + 9D

.= L + 18D

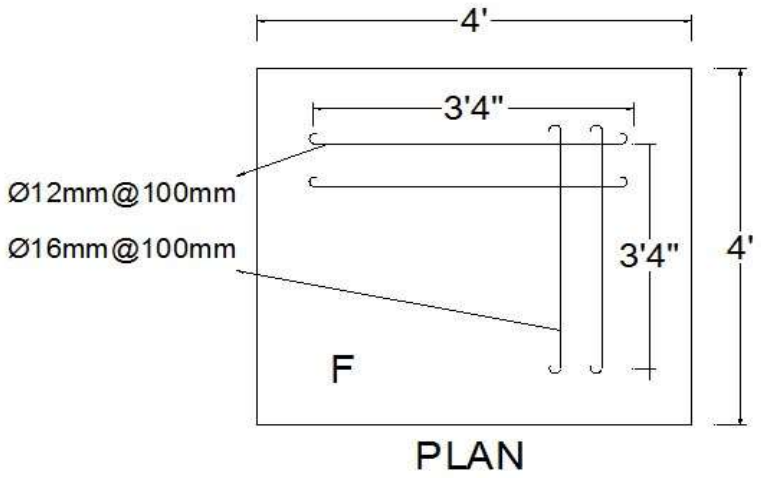
where D= dia of bar

According to condition, deduction of Concrete Cover from four sides of Footing
if Length or width of item is greater than or equal to 0.60m or 2' then cover = 4"

" L" = 4' - 4" - 4" = 3'4" = 3.333'
dia of y-bar = 16mm = 0.0524'

1. Length of y-bar = L + 18D
.= 3.333' + 18 x 0.0524'
.= 4.276'

16mm=? Ft
since 1"=25.4mm
.=16/25.4
.= 0.629" = ? Ft
since 1ft = 12"
.= 0.629/12
.= 0.0524ft



PLAN

2. No. of y-bar = (opposite length /spacing) + 1
.= (40"/4") +1
.= 11 bars

3. Total length of y-bar = no. of y-bars x length of each y-bar
.= 11 x 4.276'
.= 47.036'

4. Given dia of y-bar = 16mm

5. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 16^2 /531.36
.= 0.481 kgs/Ft

6. Total weight of Steel required = weight/Ft x Total length of y-bar x no. of footings
.= 0.481 x 47.036 x 8
.= 180.994 kgs steel required of Ø16mm

(iii). Total weight of steel required for 8 footing meshes of Ø12mm & Ø16mm

weight of x-bars required = 95.99 kgs for Ø12mm
weight of y-bars required = 180.994 kgs for Ø16mm

(iv). No. of Steel bars required of length 40Ft.

(a). Ø12mm

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar for x-bar = 12mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 12^2 /531.36
.= 0.27 kgs/Ft

4. weight of each steel bar of length 40' = 0.27 x 40 = 10.8 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar of Ø12mm .= 95.99 / 10.8
.= 8.88 or approximately equal to 9 bars of Ø12mm required.

For 8.88 steel bars the required weight of steel = 95.99 (required weight of steel)
For 9 Steel bars the required weight of steel =10.8 x 9 =97.2 kgs (Actual weight of steel)

(b). Ø16mm

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar for y-bar = 16mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 16^2 /531.36
.= 0.481 kgs/Ft

4. weight of each steel bar of length 40' = 0.481 x 40 = 19.24kgs

5. No. of Steel bars of length 40' required = wt. of steel required /wt of each steel bar of Ø12mm .= 180.994 / 19.24
.= 9.407 or approximately equal to 10 bars of Ø16mm required.

For 9.407 steel bars the required weight of steel = 180.994 (required weight of steel)
For 10 Steel bars the required wt of steel = 19.24 x 10 = 192.4 kgs (Actual wt. of steel)

(iv). Bill of Quantities for Footing reinforcement:-

BILLL OF QUANTITES FOR FOOTING REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø12mm	Kgs	48.00	97.200	9	4665.600	
2	Ø16mm	Kgs	48.00	192.400	10	9235.200	
					Total	13900.800	
				Add 10% wastage		1390.080	
			Add 5% Contingencies			695.040	
					Total	15985.920	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-3:-

For a given plan of footing find

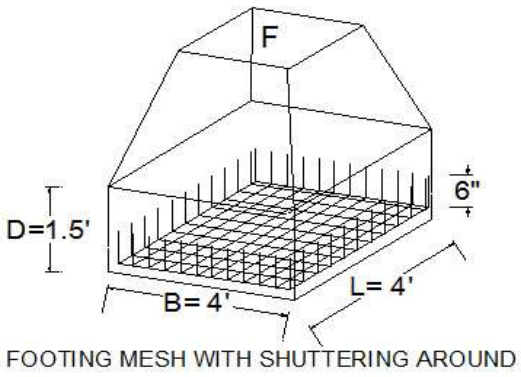
(i). Weight of Steel required for making footing meshes

(ii). No. of Steel bars required, of length 40Ft

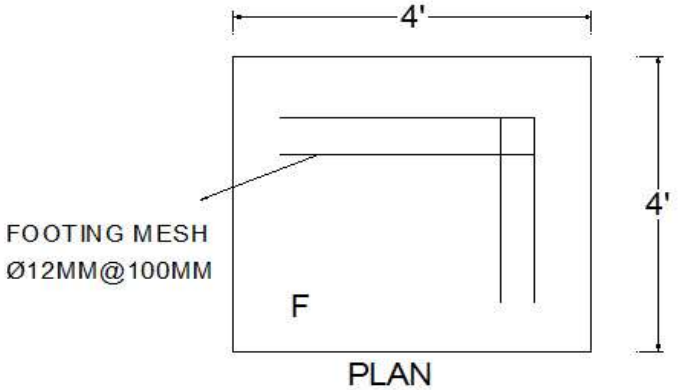
(iii). Bill of Quantities for Footing Reinforcement

Footing mesh details: Ø12mm@100mm or 4" in x-direction & y-direction

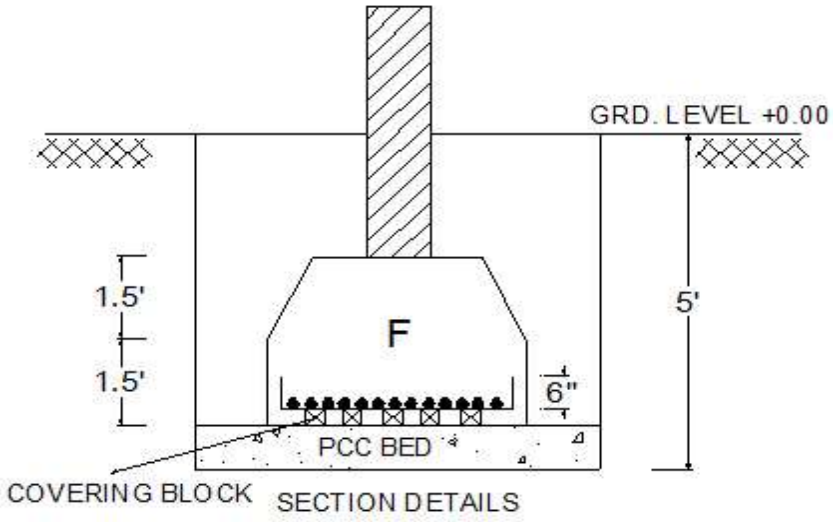
if no. of footings = 14 ; spacing = 4" and Rate of steel /kg = 48.0 rupees.



FOOTING MESH WITH SHUTTERING AROUND



PLAN



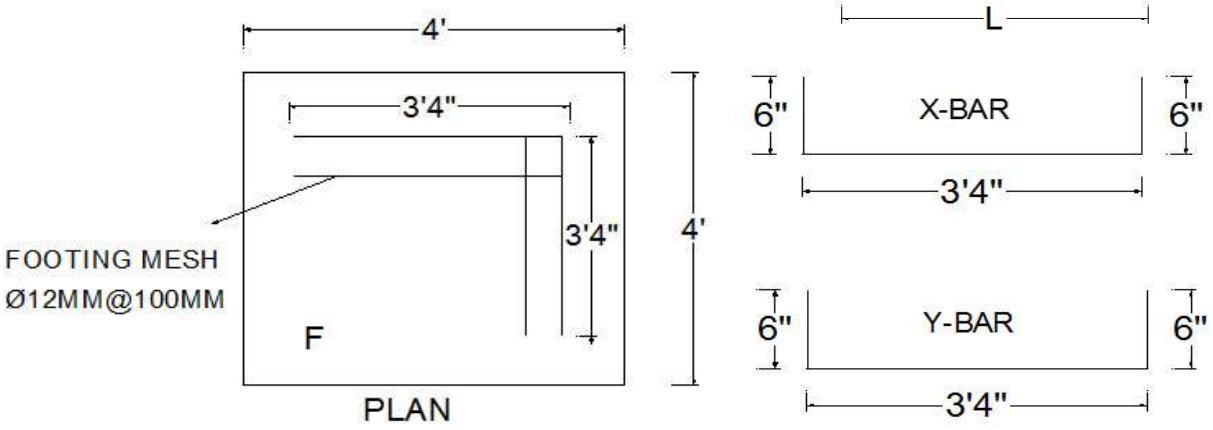
Solution:-

Total length of bar = L + 6" + 6"

.= L + 12"

L' = length of x & y bar after deduction of concrete cover

6" = Given Projection of Steel bar for footing mesh



(i). x-bar calculation:-

According to condition, deduction of Concrete Cover from four sides of Footing

if Length or width of item is greater than or equal to 0.60m or 2' then cover=4"=100mm

" L" = 4' - 4" - 4" = 3'4" = 3.333'

1. Length of x-bar = L + 6" + 6"

.= L + 12"

.= 3.333' + 1'

.= 4.333'

2. No. of x-bar = (opposite length /spacing) + 1
.= (40"/4") +1
.= 11 bars

3. Total length of x-bar = no. of x-bars X length of each x-bar
.= 11 x 4.333'
.= 47.663'

4. Given dia of x-bar = 12mm

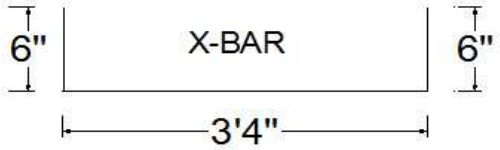
5. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 12^2 /531.36
.= 0.27 kgs/Ft

6. Total weight of Steel required = weight/Ft x Total length of x-bar x no. of footings
.= 0.27 x 47.663' x 14
.= 180.166 kgs steel required of Ø12mm

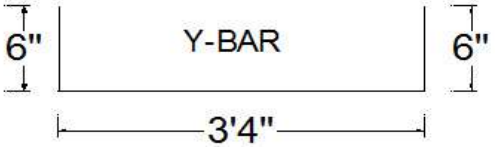
(ii). y-bar calculation:-

According to condition, deduction of Concrete Cover from four sides of Footing
if Length or width of item is greater than or equal to 0.60m or 2' then cover=4"=100mm

" L" = 4' - 4" - 4" = 3'4" = 3.333'



1. Length of y-bar = L + 6" + 6"
.= L + 12"
.= 3.333' + 1'
.= 4.333'



2. No. of y-bar = (opposite length /spacing) + 1
.= (40"/4") +1
.= 11 bars

3. Total length of y-bar = no. of y-bars x length of each y-bar
.= 11 x 4.333'
.= 47.663'

4. Given dia of y-bar = 12mm

5. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 12^2 /531.36
.= 0.27 kgs/Ft

6. Total weight of Steel required = weight/Ft x Total length of y-bar x no. of footings
.= 0.27 x 47.663' x 14
.= 180.166 kgs steel required of Ø12mm

(iii). Total weight of steel required for 14 footing meshes of Ø12mm

weight of x-bars required = 180.166
weight of y-bars required = 180.166

Total required weight of ste .= 360.332 kgs

(iv). No. of Steel bars required of length 40Ft.

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar for x-bar & y-bar = 12mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 12^2 /531.36
.= 0.27 kgs/Ft

4. weight of each steel bar of length 40' = 0.27 x 40 = 10.8 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 360.332 / 10.8
.= 33.36 or approximately equal to 34 bars of Ø12mm required.

For 33.36 steel bars the required weight of steel = 360.332 (required weight of steel)
For 34 Steel bars the required wt of steel = 10.8 x 34 = 367.20 kgs (Actual wt of steel)

(iv). Bill of Quantities for Footing reinforcement:-

BILLL OF QUANTITES FOR FOOTING REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø12mm	Kgs	48.00	367.200	34	17625.600	
					Total	17625.600	
				Add 10% wastage		1762.560	
			Add 5% Contingencies			881.280	
					Total	20269.440	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-4 :-

For a given plan of Neck Column find

(i). Weight of Steel required for Main bars and Stirrups.

(ii). No. of Steel bars required, of length 40Ft

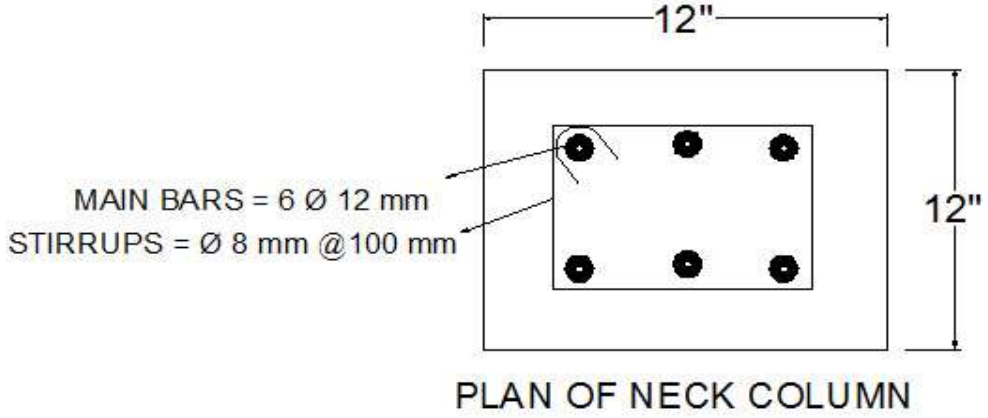
(iii). Bill of Quantities for Neck Column Reinforcement if Rate of steel /kg = 48.0 rupees.

If no. of Columns = 12 size of column = 12" x 12" Height of CRS above G.L = 1.0Ft.

Depth of excavation = 5Ft Depth of footing = 3Ft Thickness of pcc bed 4"

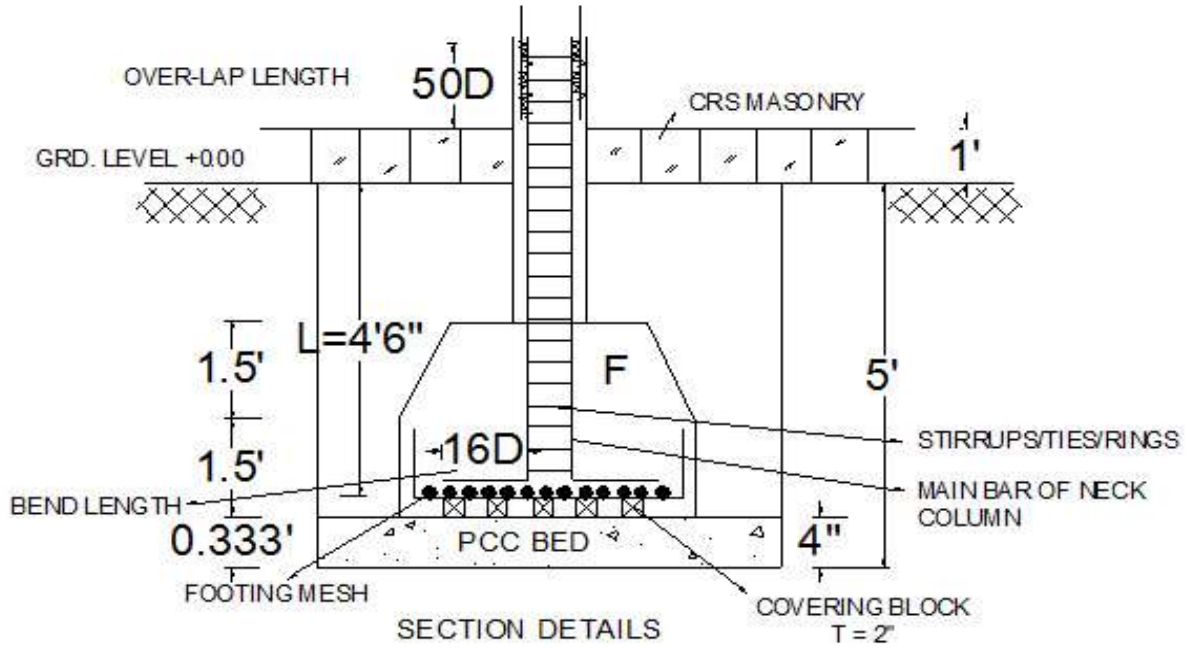
Reinforcement details for Neck column :-

(a). Main bars = 6 Ø 12mm (b). Stirrups = Ø 8mm@ 100mm or 4"



PLAN OF NECK COLUMN

Solution :-



(i). Neck Column Main bars calculations:-

"L" = Depth of Excavation - thickness of pcc bed - thickness of Covering block

L = 5' - 4" - 2"

L = 5' - 6"

L = 4.5'

Dia of Main bar = 12mm = 0.0393 Ft

Bend length = 16D : Over-lap length = 50D

1. The length of each Main bar = L + 16D + 50D + Ht. of CRS
   .= L + 66D + Ht. of CRS
   .= 4.5' + 66 x 0.0393 + 1'
   .= 8.093 Ft

12mm=? Ft
since 1"=25.4mm
.=12/25.4
.= 0.472" = ? Ft
since 1ft = 12"
.= 0.472/12
.= 0.0393ft

2. No. of Main bars = 6

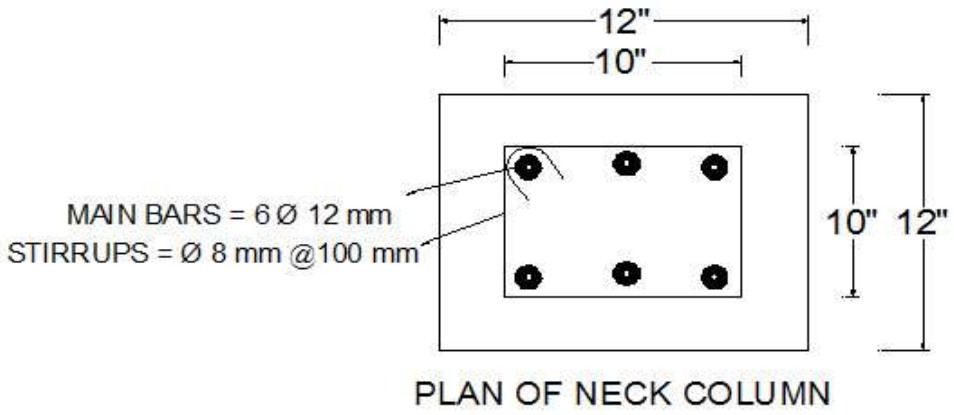
3. Total length of Main bar = length of each main bar x no. of main bars
   .= 8.093' x 6
   .= 48.558'

4. Dia of Main bar = 12mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 12^2 /531.36
.= 0.27 kgs/Ft

6. weight of Steel required = wt./Ft x Total length of Main-bar x no. of Neck columns
.= 0.27 x 48.558' x 12
.= 157.327 kgs steel required of Ø12mm

(ii). Neck Column Stirrups or Ties calculations:-



PLAN OF NECK COLUMN

Hook length = 9D
Two Hook length = 9D x 2 = 18D
where D = dia of bar
Length of each Tie = L + 18D
L = length of Tie after deduction of 1" Concrete Cover from four sides of Column with out hook length.
L = (L+B) x 2
L = (10" + 10") x 2
L = 40" = 3.333Ft
D = dia of Stirrup = 8mm = 0.0262 Ft

1. Length of Tie = L + 18D
.= 3.333' + 18 x 0.0262
.= 3.804'

8mm=? Ft
since 1"=25.4mm
.= 8/25.4
.= 0.3149" = ? Ft
since 1ft = 12"
.= 0.3149/12
.= 0.0262ft

2. No. of Ties = (Ht. of neck column / spacing) +1
.= (5.5' / 0.333') +1
.= 17.51 or approximately equal to 18 stirrups

Given spacing = 4" = 0.333Ft

Ht. of neck column = Depth of excavation - thickness of pcc - thickness of covering block + Ht. of CRS

.= 5' - 4" - 2" +1'

.= 5' -0.5' + 1'

.= 5.5ft

3. Total length of Stirrup = length of each Stirrup x no. of Stirrups

.= 3.804' x 18

.= 68.472 Ft

4. Dia of Stirrup = 8mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 8^2 /531.36

.= 0.1204 kgs/Ft

6. Weight of Steel required = weight/Ft x Total length of Stirrup x no. of Neck columns

.= 0.1204 x 68.472' x 12

.= 98.928 kgs steel required of Ø 8mm

(iii). Total weight of steel required for 12 no. of Columns of Ø12mm & Ø8mm

weight of Main bars required .= 157.327 kgs

weight of Stirrups required .= 98.928 kgs

(iv). No. of Steel bars required of length 40Ft.

(a). Ø 12mm

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar for Main bar = 12mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 12^2 /531.36

.= 0.27 kgs/Ft

4. weight of each steel bar of length 40' = 0.27 x 40 = 10.8 kgs

5. No. of Steel bars of length 40' required = wt. of steel required / wt. of each steel bar
.= 157.327 / 10.8
.= 14.56 or approximately equal to 15 bars of Ø12mm required.

For 14.56 steel bars the required weight of steel = 157.327 (required weight of steel)
For 15 Steel bars the required wt. of steel = 10.8 x 15 = 162.0 kgs (Actual wt. of steel)
(b). Ø 8mm
1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar for Stirrups = 8mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 8^2 /531.36
.= 0.1204 kgs

4. weight of each steel bar of length 40' = 0.1204 x 40 = 4.816 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 98.928 / 4.816
.= 20.54 or approximately equal to 21 bars of Ø8mm required.

For 20.54 steel bars the required weight of steel = 98.928 (required weight of steel)
For 21 Steel bars the required wt. of steel = 4.816 x 21 =101.136 kgs (Actual wt. of steel)

(v). Bill of Quantities for Neck column reinforcement:-

BILLL OF QUANTITES FOR NECK COLUMN REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø12mm	Kgs	48.00	162.000	15	7776.000	
2	Ø8mm	Kgs	48.00	101.136	21	4854.528	
					Total	12630.528	
				Add 10% wastage		1263.053	
			Add 5% Contingencies			631.526	
					Total	14525.107	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-5 :-

For a given plan of Plinth beam find

(i). Weight of Steel required for Main bars and Stirrups.

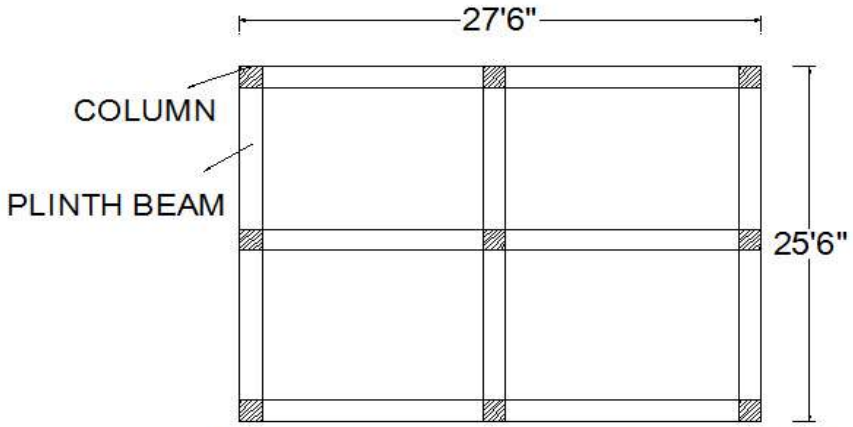
(ii). No. of Steel bars required, of length 40Ft

(iii). Bill of Quantities for Plinth beam Reinforcement if Rate of steel /kg = 48.0 rupees.

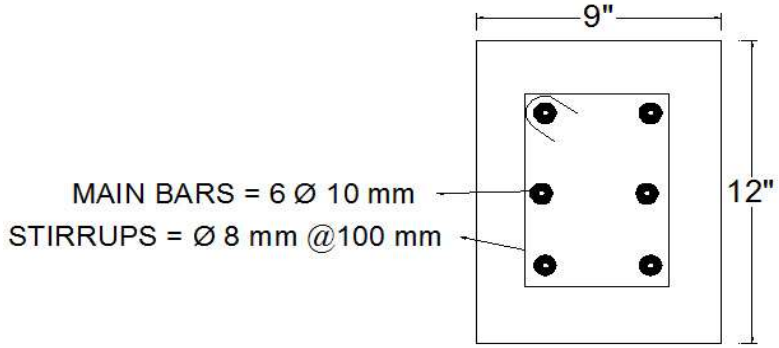
size of Plinth beam = 9" x 12" size of column = 9" x 12"

Reinforcement details for Plinth beams :-

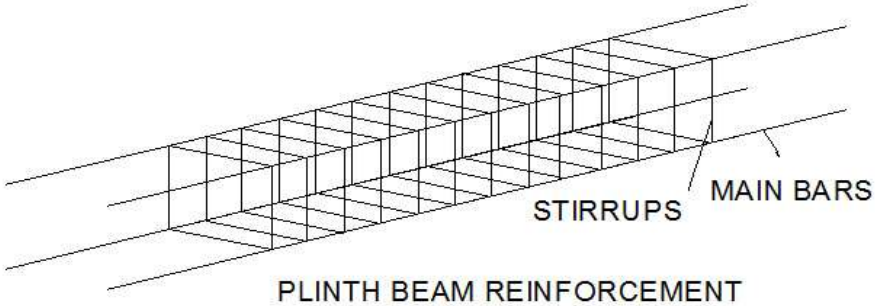
(a). Main bars = 6 Ø 10mm (b). Stirrups = Ø 8mm@ 100mm or 4"



PLAN SHOWING PLINTH BEAM DETAILS

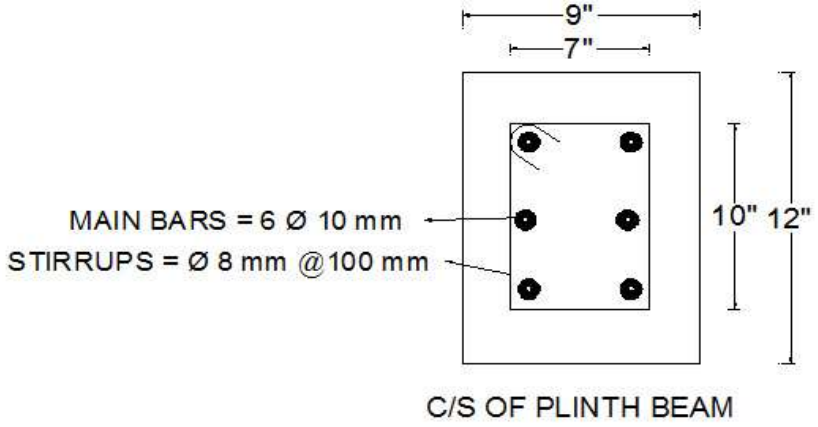


C/S OF PLINTH BEAM



PLINTH BEAM REINFORCEMENT

Solution :-



C/S OF PLINTH BEAM

(i). Plinth beam main bar calculations:-

(a). Plinth beam along horizontal axis"

Given size of Column = 9" x 12"

No. of Plinth beams along horizontal axis = 3

Length of Plinth beam including column length = 27'6"

1. Length of each Main bar = 27'6" - 1" - 1"

.= 27'4" (Deduction of 1" concrete cover from both side)

.= 27.333'

2. No. of Main bars = 6

3. Total length of Main bars .= length of each Main bar x no. of Main bars x no. of Plinth beams

.= 27.333' x 6 x 3

.= 491.994'

(b). Plinth beam along vertical axis"

Given size of Column = 9" x 12"

No. of Plinth beams along vertical axis = 3

Length of Plinth beam including Column length = 25'6"

1. Length of each Main bar = 25'6" - 1" - 1"

.= 25'4" (Deduction of 1" concrete cover from both side)

.= 25.333'

2. No. of Main bars = 6

3. Total length of Main bars .= length of each Main bar x no. of Main bars x no. of Plinth beams

.= 25.333' x 6 x 3

.= 455.994'

(c). Total length of Main bars along horizontal and vertical axis :-

length of steel bar along horizontal axis .= 491.994'

length of steel bar along vertical axis .= 455.994'

Total length of Main bars .= 947.988'

(d). Weight of steel required for Main bars :-

1. Total length of Main bars = 947.988 Ft
2. Dia of Main bar = 10mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 10^2 /531.36

.= 0.1881 kgs/Ft

4. Total weight of Steel required = weight/Ft x Total length of Main bars

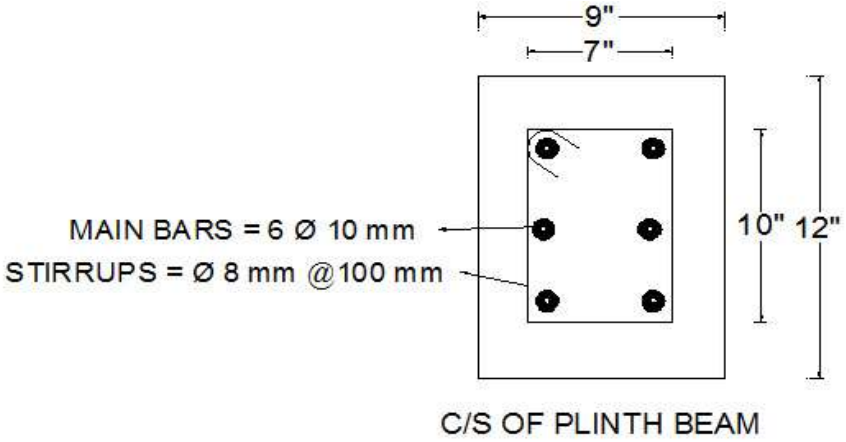
.= 0.1881 x 947.998

.= 178.316 kgs steel required of Ø 10mm

(ii). Plinth beam -Stirrups calculations:-

Stirrups are provided in plinth beam up to Plinth beam length, excluding Columns

Size of Column = 9" x 12"



C/S OF PLINTH BEAM

Length of Plinth beam along horizontal axis .= 27'6" - 9" - 9" - 9"

excluding Column length .= 27.5' - 0.75' - 0.75' - 0.75'

.= 25.25'

No. of Plinth beam along horizontal axis .= 3

Length of Plinth beam along vertical axis .= 25'6" - 12" - 12" - 12"
excluding Column length .= 25.5' - 1' - 1' -1'
.= 22.5'
No. of Plinth beam along vertical axis .= 3

Total length of Plinth beam .= 25.25' x 3 + 22.5' x 3
.= 143.25Ft

Length of each Stirrup .= L + 18D
where 'L' = length of stirrup after deduction of 1" concrete cover
'D' = dia of Stirrup = 8mm = 0.0262 Ft

L = (L + B) x 2
.= (7" + 10) x 2
.= 34"
.= 2.833 Ft

8mm=? Ft
since 1"=25.4mm
.= 8/25.4
.= 0.3149" = ? Ft
since 1ft = 12"
.= 0.3149/12
.= 0.0262ft

1. Length of each Stirrup .= L + 18D
.= 2.833 + 18 x 0.0262
.= 3.304'

2. No. of Stirrups .= (length of Plinth beam / spacing) + 1
Given spacing = 100mm .= (143.25 / 0.333) + 1
.= 4" = 0.333 Ft .= 431.18 or approximately equal to 432 Ties

3.Total length of Stirrups .= length of each Tie x no. of Ties
.= 3.304 x 432
.= 1427.328 Ft

4. Dia of Stirrup .= 8mm
5. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 8^2 /531.36
.= 0.1204 kgs/Ft

6. Total weight of Steel required = weight/Ft x Total length of stirrup
.= 0.1204 x 1427.328'
.= 171.850 kgs steel required of Ø 8mm

(iii). Total weight of steel required for Plinth beams of Ø10mm & Ø8mm

weight of Main bars required .= 178.316 kgs
weight of Stirrups required .= 171.850 kgs

(iv). No. of Steel bars required of length 40Ft.

(a). Ø 10mm

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar for Main bar = 10mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
   .= 10^2 /531.36
   .= 0.1881 kgs/Ft

4. weight of each steel bar of length 40' = 0.1881 x 40 = 7.524 kgs

5. No. of Steel bars of length 40' required = wt. of steel required / wt. of each steel bar
   .= 178.316 / 7.524
   .= 23.69 or approximately equal to 24 bars of Ø10mm required.

For 23.69 steel bars the required weight of steel = 178.316 kgs (required wt. of steel)
For 24 Steel bars the required wt. of steel = 7.524 x 24 = 180.576 kgs (Actual wt of steel)

(b). Ø 8mm

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar for Stirrups = 8mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
   .= 8^2 /531.36
   .= 0.1204 kgs

4. weight of each steel bar of length 40' = 0.1204 x 40 = 4.816 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
   .= 171.850 / 4.816
   .= 35.68 or approximately equal to 36 bars of Ø8mm required.

For 35.68 steel bars the required weight of steel = 171.850 kgs (required wt of steel)
For 36 Steel bars the required wt of steel = 4.816 x 36 = 173.376 kgs (Actual wt of steel)

(v). Bill of Quantities for Plinth beam reinforcement:-

BILLL OF QUANTITES FOR PLINTH BEAM REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø10mm	Kgs	48.00	180.576	24	8667.648	
2	Ø8mm	Kgs	48.00	173.376	36	8322.048	
					Total	16989.696	
				Add 10% wastage		1698.970	
			Add 5% Contingencies			849.485	
					Total	19538.150	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-6 :-

From the given plan and section Dwg. of Floor Column Find

(i). Weight of Steel required for Main bars and Stirrups.

(ii). No. of Steel bars required, of length 40Ft

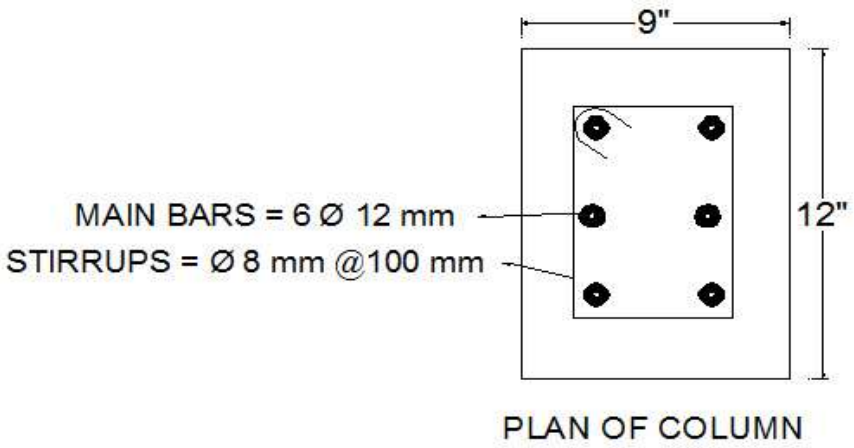
(iii). Bill of Quantities for Floor Column Reinforcement if Rate of steel /kg = 48.0 rupees.

size of Column = 9" x 12" ; height of Ceiling = 10'

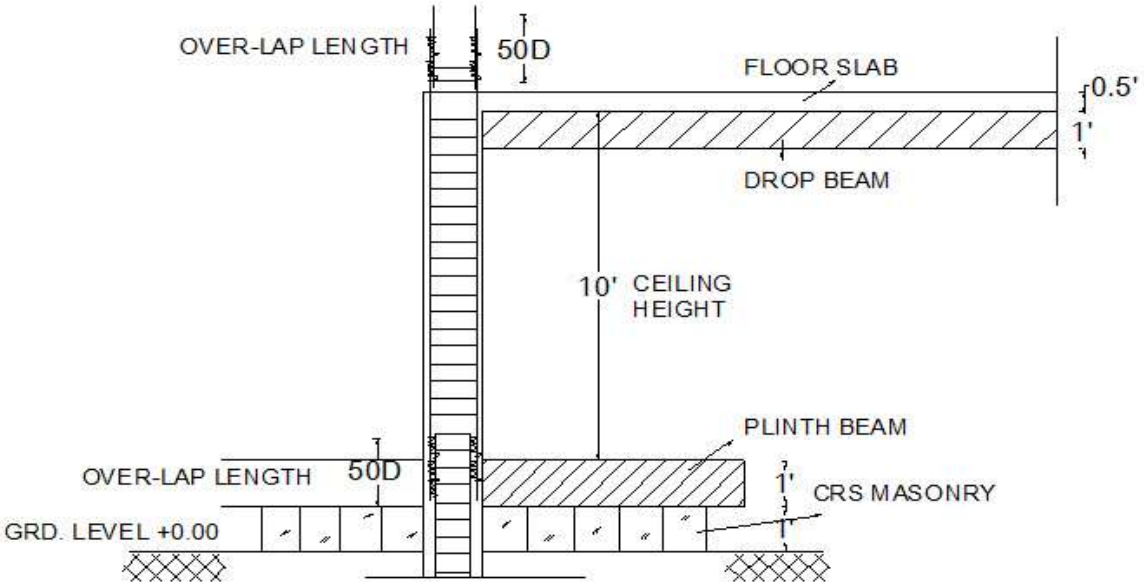
No. of Floor Columns = 6 and Thickness of Floor Slab = 6"

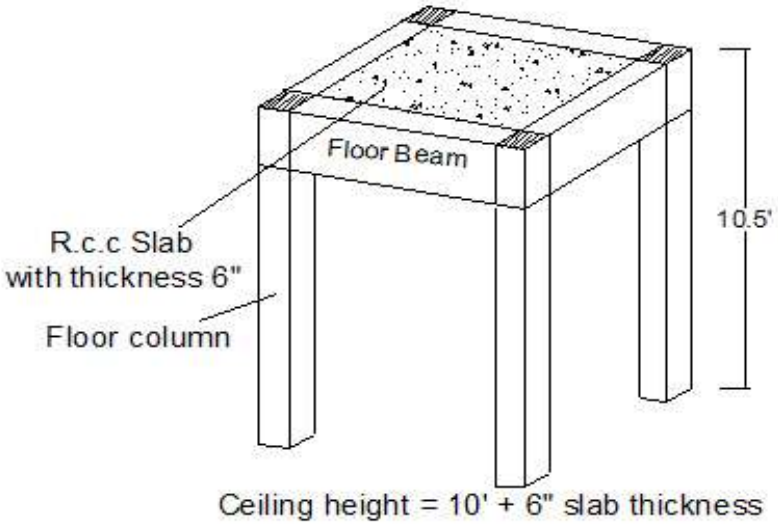
Reinforcement Details for Floor Columns :

(a). Main bars = 6 Ø12mm (b). Stirrups = Ø8mm@100mm or 4"



PLAN OF COLUMN





Solution :-

(i). Floor Column Main bars calculations:-

1. Length of each Main bar :-

"L" = Height of Ceiling + Thickness of Floor Slab + Over-lap length

L = 10' + 6" + 50D

L = 10' + 0.5' + 50 x 0.0393'

L = 12.465'

Dia of Main bar = 12mm = 0.0393 Ft

Over-lap length = 50D

2. No. of Main bars = 6

12mm=? Ft

since 1"=25.4mm

.=12/25.4

.= 0.472" = ? Ft

since 1ft = 12"

.= 0.472/12

.= 0.0393ft

3. Total length of Main bar = length of each main bar x no. of main bars

.= 12.465' x 6

.= 74.79'

4. Dia of Main bar = 12mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 12^2 /531.36

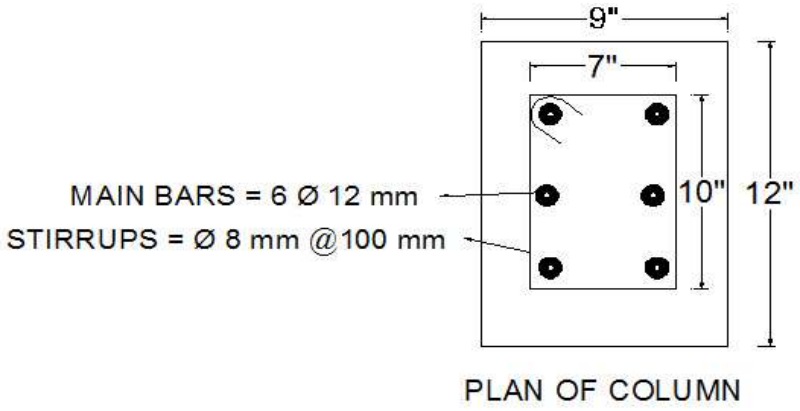
.= 0.27 kgs/Ft

6. Total wt of Steel required = wt/Ft x Total length of Main-bar x no. of Floor columns

.= 0.27 x 74.79' x 6

.= 121.159 kgs steel required of Ø12mm

(ii). Floor Column Stirrups or Ties calculations:-



PLAN OF COLUMN

Hook length = 9D

Two Hook length = 9D x 2 = 18D

where D = dia of bar

Length of each Tie = L + 18D

L = length of Tie after deduction of 1" Concrete Cover from four sides of Column with-

L = (L+B) x 2 out hook length

L = (7" + 10") x 2

L = 34" = 2.833Ft

D = dia of Stirrup = 8mm = 0.0262 Ft

1. Length of Tie = L + 18D

.= 2.833' + 18 x 0.0262

.= 3.304'

8mm=? Ft

since 1"=25.4mm

.= 8/25.4

.= 0.3149" = ? Ft

since 1ft = 12"

.= 0.3149/12

.= 0.0262ft

2. No. of Ties = (Ht. of Ceiling / spacing) +1

.= (10' / 0.333') +1

.= 31.03 or approximately equal to 31 stirrups

Given spacing = 4" = 0.333Ft

Note: Stirrups shall be provided up to ceiling height only.

3. Total length of Stirrup = length of each Stirrup x no. of Stirrups

.= 3.304' x 31

.= 102.424 Ft

4. Dia of Stirrup = 8mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 8^2 /531.36

.= 0.1204 kgs/Ft

6. Total wt of Steel required = wt/Ft x Total length of Stirrup x no. of Floor Columns

.= 0.1204 x 102.424' x 6

.= 73.991 kgs steel required of Ø 8mm

(iii). Total weight of steel required for 6 no. of Columns of Ø12mm & Ø8mm

weight of Main bars required .= 121.159 kgs

weight of Stirrups required .= 73.991 kgs

(iv). No. of Steel bars required of length 40Ft.

(a). Ø 12mm

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar for Main bar = 12mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 12^2 /531.36

.= 0.27 kgs/Ft

4. weight of each steel bar of length 40' = 0.27 x 40 = 10.8 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar

.= 121.159 / 10.8

.= 11.21 or approximately equal to 12 bars of Ø12mm required.

For 11.21 steel bars the required weight of steel = 121.159 (required weight of steel)

For 12 Steel bars the required wt of steel = 10.8 x 12 = 129.6 kgs (Actual wt of steel)

(b). Ø 8mm

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar for Stirrups = 8mm
3. Weight of Steel bar in kgs / Ft $.= d^2/531.36$
   $.= 8^2/531.36$
   $.= 0.1204$ kgs

4. weight of each steel bar of length 40' = 0.1204 x 40 = 4.816 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
   .= 73.991 / 4.816
   .= 15.36 or approximately equal to 16 bars of Ø8mm required.

For 15.36 steel bars the required weight of steel = 73.991 (required weight of steel)
For 16 Steel bars the required wt of steel = 4.816 x 16 = 77.056 kgs (Actual wt of steel)

(v). Bill of Quantities for Floor Columns reinforcement:-

BILLL OF QUANTITES FOR FLOOR COLUMNS REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø12mm	Kgs	48.00	129.600	12	6220.800	
2	Ø8mm	Kgs	48.00	77.056	16	3698.688	
					Total	9919.488	
				Add 10% wastage		991.949	
			Add 5% Contingencies			495.974	
					Total	11407.411	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-7 :-

For a given plan & Section Dwg. of Floor beamS find

(i). Weight of Steel required for Main bars and Stirrups.

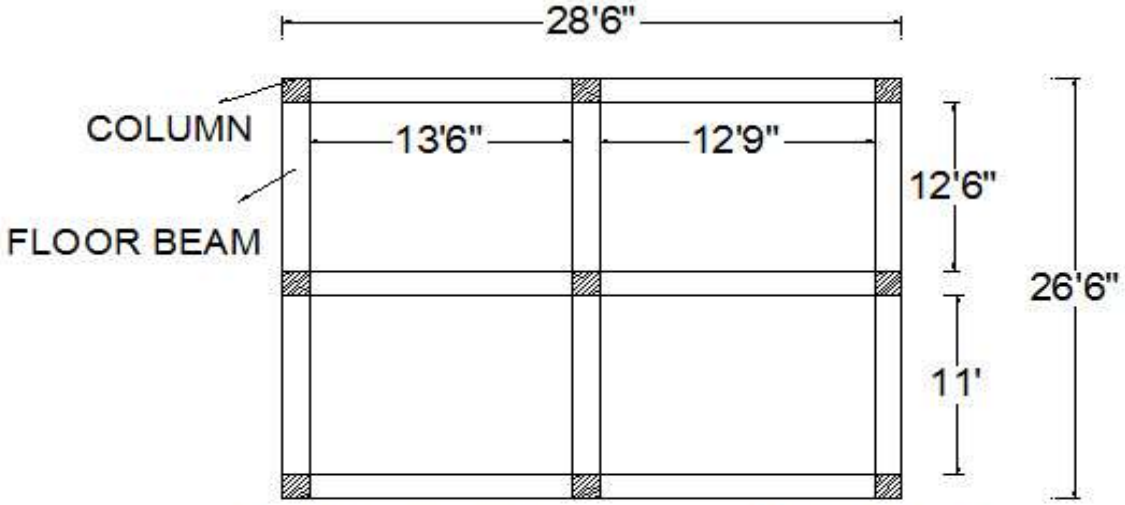
(ii). No. of Steel bars required, of length 40Ft

(iii). Bill of Quantities for Floor beam Reinforcement if Rate of steel /kg = 48.0 rupees.

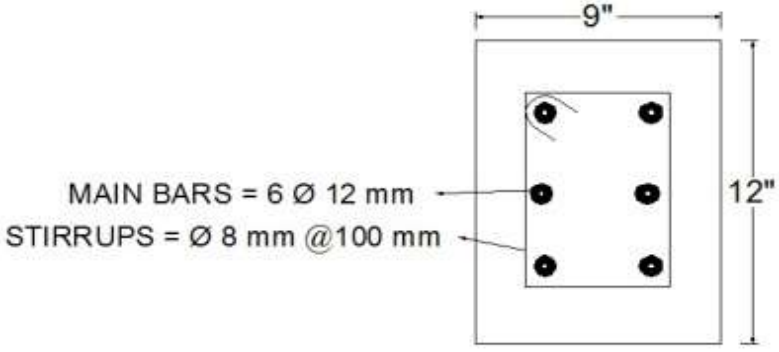
Floor beam details: size of Floor beam = 9" x 12" size of column = 9" x 12"

Reinforcement details for Floor beams :-

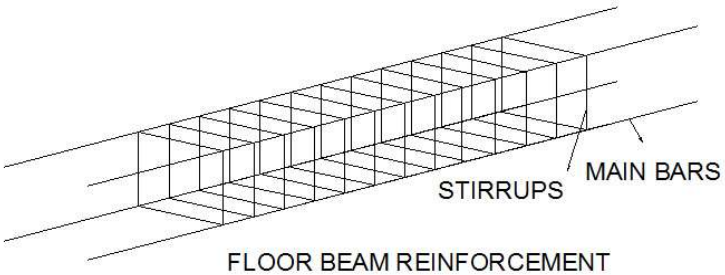
(a). Main bars = 6 Ø 12mm (b). Stirrups = Ø 8mm@ 100mm or 4"



PLAN SHOWING FLOOR BEAM DETAILS

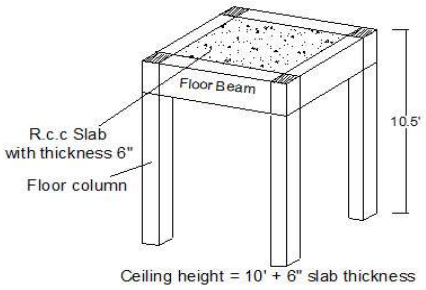


C/S OF FLOOR BEAM



FLOOR BEAM REINFORCEMENT

Solution :-



(i). Floor beam main bars calculations:-

(a). Floor beam along horizontal axis"

Given size of Column = 9" x 12"

No. of Floor beams along horizontal axis = 3

Length of Floor beam including column length = 28'6"

1. Length of each Main bar = 28'6" - 1" - 1"

.= 28'4" (Deduction of 1" concrete cover from both side)

.= 28.333'

2. No. of Main bars = 6

3. Total length of Main bars = length of each Main bar x no. of Main bars x no. of Floor beams

.= 28.333' x 6 x 3

.= 509.994'

(b). Floor beam along vertical axis"

Given size of Column = 9" x 12"

No. of Floor beams along vertical axis = 3

Length of Floor beam including Column length = 26'6"

1. Length of each Main bar = 26'6" - 1" - 1"

.= 26'4" (Deduction of 1" concrete cover from both side)

.= 26.333'

2. No. of Main bars = 6

3. Total length of Main bars = length of each Main bar x no. of Main bars x no. of Floor beams

.= 26.333' x 6 x 3

.= 473.994'

(c). Total length of Main bars along horizontal and vertical axis :-

length of steel bar along horizontal axis .= 509.994

length of steel bar along vertical axis .= 473.994'

Total length of Main bars .= 983.988'

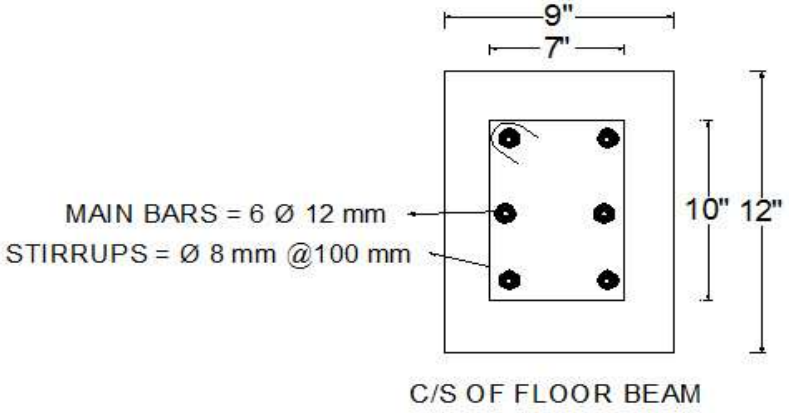
(d). Weight of steel required for Main bars :-

1. Total length of Main bars .= 983.988 Ft
2. Dia of Main bar = 12mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
   .= 12^2 /531.36
   .= 0.27 kgs/Ft

4. Total weight of Steel required = weight/Ft x Total length of Main bars
   .= 0.27 x 983.998
   .= 265.679 kgs steel required of Ø 12mm

(ii). Floor beam -Stirrups calculations:-

Stirrups are provided in Floor beam up to Floor beam length, excluding Column length. Size of Column = 9" x 12"



C/S OF FLOOR BEAM

Length of Floor beam along horizontal axis	.= 28'6" - 9" - 9" - 9"
excluding Column length	.= 28.5' - 0.75' - 0.75' - 0.75'
	.= 26.25'
No. of Floor beam along horizontal axis	.= 3
Length of Floor beam along vertical axis	.= 26'6" - 12" - 12" - 12"
excluding Column length	.= 26.5' - 1' - 1' -1'
	.= 23.5'
No. of Floor beam along vertical axis	.= 3
Total length of Floor beam	.= 26.25' x 3 + 23.5' x 3
	.= 149.25Ft

Length of each Stirrup .= L + 18D

where 'L' = length of stirrup after deduction of 1" concrete cover

'D' = dia of Stirrup = 8mm = 0.0262 Ft

L = (L + B) x 2

.= (7" + 10) x 2

.= 34"

.= 2.833 Ft

8mm=? Ft

since 1"=25.4mm

.= 8/25.4

.= 0.3149" = ? Ft

since 1ft = 12"

.= 0.3149/12

.= 0.0262ft

1. Length of each Stirrup .= L + 18D
.= 2.833 + 18 x 0.0262
.= 3.304'

2. No. of Stirrups .= (length of Floor beam / spacing) + 1
Given spacing = 100mm .= (149.25 / 0.333) + 1
.= 4" = 0.333 Ft .= 449.198 or approximately equal to 450 Ties

3. Total length of Stirrups .= length of each Tie x no. of Ties
.= 3.304 x 450
.= 1486.8 Ft

4. Dia of Stirrup .= 8mm

5. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 8^2 /531.36
.= 0.1204 kgs/Ft

6. Total weight of Steel required = weight/Ft x Total length of stirrup
.= 0.1204 x 1486.8
.= 179.01 kgs steel required of Ø 8mm

(iii). Total weight of steel required for Floor beams of Ø12mm & Ø8mm

weight of Main bars required .= 265.679 kgs
weight of Stirrups required .= 179.01 kgs

(iv). No. of Steel bars required of length 40Ft.

(a). Ø 12mm

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar for Main bar = 12mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 12^2 /531.36
.= 0.27 kgs/Ft

4. weight of each steel bar of length 40' = 0.27 x 40 = 10.8 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 265.679 / 10.8
.= 24.59 or approximately equal to 25 bars of Ø12mm required.

For 24.59 steel bars the required wt of steel = 265.679 kgs (required wt of steel)
For 25 Steel bars the required wt of steel = 10.8 x 25 = 270.0 kgs (Actual wt of steel)

(b). Ø 8mm

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar for Stirrups = 8mm

3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 8^2 /531.36
.= 0.1204 kgs

4. weight of each steel bar of length 40' = 0.1204 x 40 = 4.816 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 179.01 / 4.816
.= 37.16 or approximately equal to 38 bars of Ø8mm required.

For 37.16 steel bars the required weight of steel = 179.01 kgs (required weight of steel)
For 38 Steel bars the required wt of steel = 4.816 x 38 = 183.008 kgs (Actual wt of steel)

(v). Bill of Quantities for Floor beam reinforcement:-

BILLL OF QUANTITES FOR FLOOR BEAMS REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø12mm	Kgs	48.00	270.000	25	12960.000	
2	Ø8mm	Kgs	48.00	183.008	38	8784.384	
					Total	21744.384	
				Add 10% wastage		2174.438	
			Add 5% Contingencies			1087.219	
					Total	25006.042	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-8 :-

For a given plan & Section Dwg. of Floor Slab find

(i). Weight of Steel required for Main bars and Extra bars

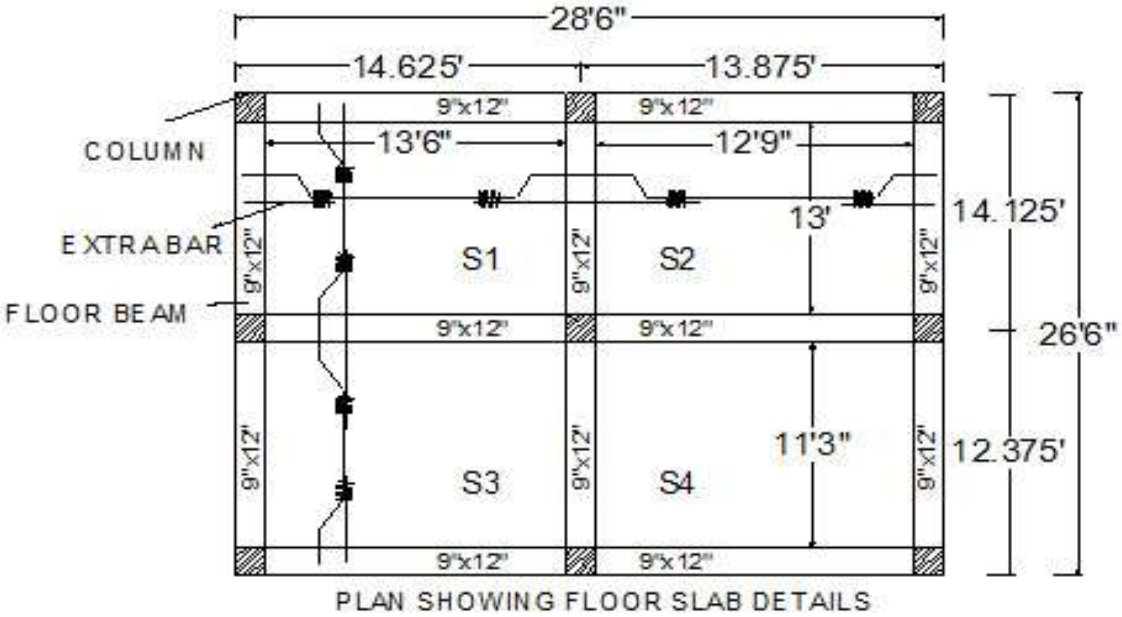
(ii). No. of Steel bars required, of length 40Ft

(iii). Bill of Quantities for Floor Slab Reinforcement if Rate of steel /kg = 48.0 rupees.

size of Floor beam = 9" x 12" size of column = 9" x 12" Slab thickness = 6"

Reinforcement details for Floor Slabs :-

(a). Slab mesh = Ø 10mm@100mm or 4 (b). Extra bar = Ø 8mm@ 100mm or 4"



PLAN SHOWING FLOOR SLAB DETAILS

Solution :-

According to conditions, 1 inch concrete cover shall be deducted from 4 sides of Slab

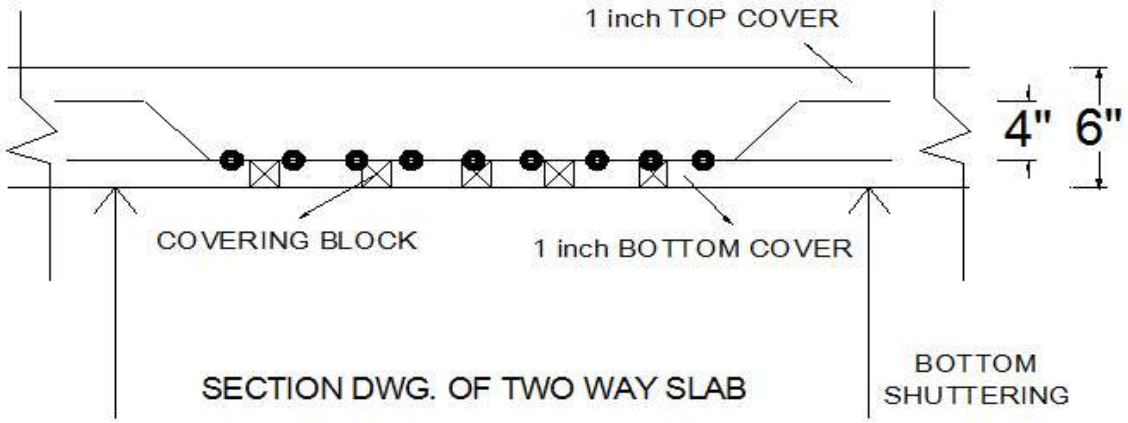
SLAB-1:-

(i). Main bar and Distribution bar calculation (Slab-1) :-

1. Length of x-bar .= L + 0.42D + 0.42D - 1"
.= L + 0.84D - 1"
.= 14.625' + 0.84D - 1" 1" = 0.0833'
.= 14.625' + 0.84 x 4" - 1" 4" = 0.333'
.= 14.625' + 0.84 x 0.333 - 0.0833'
.= 14.821'

D = Depth of Slab - top cover - bottom cover

D = 6" - 1" - 1" = 4"



SECTION DWG. OF TWO WAY SLAB

2. Length of y-bar .= L + 0.42D + 0.42D - 1"
.= L + 0.84D - 1"
.= 14.125' + 0.84D - 1"
.= 14.125' + 0.84 x 4" - 1" 1" = 0.0833'
.= 14.125' + 0.84 x 0.333 - 0.0833' 4" = 0.333'
.= 14.321'

3. No. of x-bars = (opposite length / spacing) + 1
.= (13'/ 4") + 1
.= (156"/4") +1 Opp. length = internal breadth of Slab
.= 40 bars Given spacing = 4"

4. No. of y-bars = (opposite length / spacing) + 1
.= (13'6"/ 4") + 1 Opp. length = internal length of Slab
.= (162"/4") +1 Given spacing = 4"
.= 41.5 bars or approximately equal to 42 bars

5. Total length of x-bar & y-bar = length of x-bar x no. of x-bars + length of y-bar x no. of y-bars

.= 14.821 x 40 + 14.321 x 42

.= 1194.322 Ft

(ii). Extra- bar calculation (Slab-1) :- Extra bar = Ø 8mm@ 100mm or 4"

1. The length of each Extra bar in x-direction = (L/4) + 50D

where D = dia of bar; L = length of Crank bar including crank length

Given dia of bar = 8mm = 0.0262' .= (14.821'/4) + 50 x 0.0262'

.= 5.015'

2. The length of each Extra bar in y-direction = (L/4) + 50D

where D = dia of bar; L = length of Crank bar including crank length

Given dia of bar = 8mm = 0.0262' .= (14.321'/4) + 50 x 0.0262'

.= 4.89'

8mm=? Ft

since 1"=25.4mm

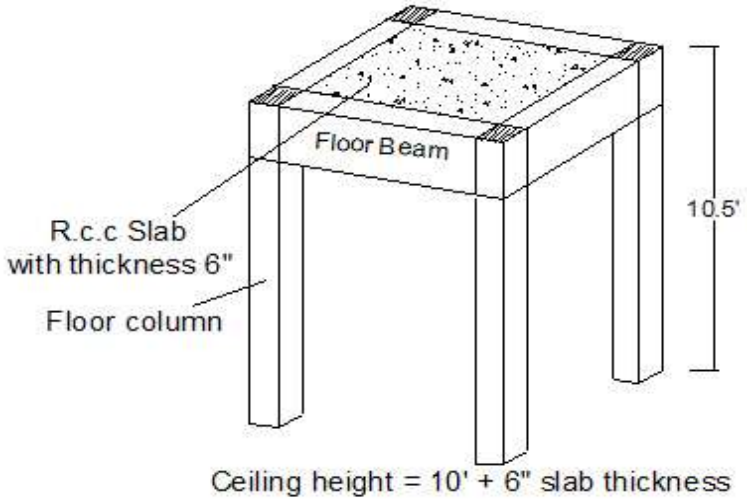
.= 8/25.4

.= 0.3149" = ? Ft

since 1ft = 12"

.= 0.3149/12

.= 0.0262ft



3. No. of Extra-bar in x-direction = no. of x-bars x 2

.= 40 x 2 = 80 bars

4. No. of Extra-bar in y-direction = no. of y-bars x 2

.= 42 x 2 = 84 bars

5. Total length of Extra bar = length of each Extra bar in x-direction x no. of Extra bar in x-direction + length of each Extra bar in y-direction **x** no. of Extra bar in y-direction

.= 5.015' x 80 + 4.58 x 84

.= 785.92 Ft

SLAB-2:-

(i). Main bar and Distribution bar calculation (Slab-2) :-

1. Length of x-bar .= L + 0.42D + 0.42D - 1"
.= L + 0.84D - 1"
.= 13.875' + 0.84D - 1"
.= 13.875' + 0.84 x 4" - 1"
.= 13.875' + 0.84 x 0.333 - 0.0833'
.= 14.071'

D = Depth of Slab - top cover - bottom cover
D = 6" - 1" - 1"
D = 4"

1" = 0.0833'
4" = 0.333'

2. Length of y-bar .= L + 0.42D + 0.42D - 1"
.= L + 0.84D - 1"
.= 14.125' + 0.84D - 1"
.= 14.125' + 0.84 x 4" - 1"
.= 14.125' + 0.84 x 0.333 - 0.0833'
.= 14.321'

3. No. of x-bars = (opposite length / spacing) + 1
.= (13'/ 4") + 1
.= (156"/4") +1
.= 40 bars

Opp. length = internal breadth of Slab
Given spacing = 4"

4. No. of y-bars = (opposite length / spacing) + 1
.= (12'9"/ 4") + 1
.= (153"/4") +1
.= 39.25 bars or approximately equal to 40 bars

Opp. length = internal length of Slab
Given spacing = 4"

5. Total length of x-bar & y-bar = length of x-bar x no. of x-bars + length of y-bar x no. of y-bars
.= 14.071 x 40 + 14.321 x 40
.= 1135.68 Ft

(ii). Extra- bar calculation (Slab-2) :- Extra bar = Ø 8mm@ 100mm or 4"

1. The length of each Extra bar in x-direction = (L/4) + 50D

where D = dia of bar; L = length of Crank bar including crank length

Given dia of bar = 8mm = 0.0262' .= (14.071'/4) + 50 x 0.0262'

.= 4.827'

2. The length of each Extra bar in y-direction = (L/4) + 50D

where D = dia of bar; L = length of Crank bar including crank length

Given dia of bar = 8mm = 0.0262' .= (14.321'/4) + 50 x 0.0262'

.= 4.89'

3. No. of Extra-bar in x-direction = no. of x-bars x 2

.= 40 x 2 = 80 bars

4. No. of Extra-bar in y-direction = no. of y-bars x 2

.= 40 x 2 = 80 bars

5. Total length of Extra bar = length of each Extra bar in x-direction x no. of Extra bar in x-direction + length of each Extra bar in y-direction **x** no. of Extra bar in y-direction

.= 4.827' x 80 + 4.89 x 80

.= 777.36 Ft

SLAB-3:-

(i). Main bar and Distribution bar calculation (Slab-3) :-

1. Length of x-bar .= L + 0.42D + 0.42D - 1"

.= L + 0.84D - 1"

.= 14.625' + 0.84D - 1"

.= 14.625' + 0.84 x 4" - 1"

.= 14.625' + 0.84 x 0.333 - 0.0833'

.= 14.821'

D = Depth of Slab - top cover - bottom cover

D = 6" - 1" - 1"

D = 4"

1" = 0.0833'

4" = 0.333'

2. Length of y-bar .= L + 0.42D + 0.42D - 1"
.= L + 0.84D - 1"
.= 12.375' + 0.84D - 1"
.= 12.375' + 0.84 x 4" - 1"
.= 12.375' + 0.84 x 0.333 - 0.0833'
.= 12.571'

3. No. of x-bars = (opposite length / spacing) + 1
.= (11'3"/ 4") + 1 Opp. length = internal breadth of Slab
.= (135"/4") +1 Given spacing = 4"
.= 34.75 bars or approximately equal to 35 bars

4. No. of y-bars = (opposite length / spacing) + 1
.= (13'6"/ 4") + 1 Opp. length = internal length of Slab
.= (162"/4") +1 Given spacing = 4"
.= 41.5 bars or approximately equal to 42 bars

5. Total length of x-bar & y-bar = length of x-bar x no. of x-bars + length of y-bar x no. of y-bars
.= 14.821 x 35 + 12.571 x 42
.= 1046.717 Ft

(ii). Extra- bar calculation (Slab-3) :- Extra bar = Ø 8mm@ 100mm or 4"

1. The length of each Extra bar in x-direction = (L/4) + 50D
where D = dia of bar; L = length of Crank bar including crank length
Given dia of bar = 8mm = 0.0262' .= (14.821'/4) + 50 x 0.0262'
.= 4.705'

2. The length of each Extra bar in y-direction = (L/4) + 50D
where D = dia of bar; L = length of Crank bar including crank length
Given dia of bar = 8mm = 0.0262' .= (12.571'/4) + 50 x 0.0262'
.= 4.452'

3. No. of Extra-bar in x-direction = no. of x-bars x 2
.= 35 x 2 = 70 bars

4. No. of Extra-bar in y-direction = no. of y-bars x 2
.= 42 x 2 = 84 bars

5. Total length of Extra bar = length of each Extra bar in x-direction x no. of Extra bar in x-direction + length of each Extra bar in y-direction **x** no. of Extra bar in y-direction

.= 4.705' x 70 + 4.452 x 84

.= 703.318 Ft

SLAB-4:-

(i). Main bar and Distribution bar calculation (Slab-4) :-

1. Length of x-bar .= L + 0.42D + 0.42D - 1"

.= L + 0.84D - 1"

.= 13.875' + 0.84D - 1"

.= 13.875' + 0.84 x 4" - 1"

.= 13.875' + 0.84 x 0.333 - 0.0833'

.= 14.071'

D = Depth of Slab - top cover - bottom cover

D = 6" - 1" - 1"

D = 4"

1" = 0.0833'

4" = 0.333'

2. Length of y-bar .= L + 0.42D + 0.42D - 1"

.= L + 0.84D - 1"

.= 12.375' + 0.84D - 1"

.= 12.375' + 0.84 x 4" - 1"

.= 12.375' + 0.84 x 0.333 - 0.0833'

.= 12.571'

3. No. of x-bars = (opposite length / spacing) + 1

.= (11'3"/ 4") + 1 Opp. length = internal breadth of Slab

.= (135"/4") +1 Given spacing = 4"

.= 34.75 bars or approximately equal to 35 bars

4. No. of y-bars = (opposite length / spacing) + 1

.= (12'9"/ 4") + 1 Opp. length = internal length of Slab

.= (153"/4") +1 Given spacing = 4"

.= 39.25 bars or approximately equal to 40 bars

5. Total length of x-bar & y-bar = length of x-bar **x** no. of x-bars **+** length of y-bar **x** no. of y-bars

.= 14.071 x 35 + 12.571 x 40

.= 995.325 Ft

(ii). Extra- bar calculation (Slab-4) :- Extra bar = Ø 8mm@ 100mm or 4"

1. The length of each Extra bar in x-direction = (L/4) + 50D
where D = dia of bar; L = length of Crank bar including crank length
Given dia of bar = 8mm = 0.0262' .= (14.071'/4) + 50 x 0.0262'
.= 4.827'

2. The length of each Extra bar in y-direction = (L/4) + 50D
where D = dia of bar; L = length of Crank bar including crank length
Given dia of bar = 8mm = 0.0262' .= (12.571'/4) + 50 x 0.0262'
.= 4.452'

3. No. of Extra-bar in x-direction = no. of x-bars x 2
.= 35 x 2 = 70 bars

4. No. of Extra-bar in y-direction = no. of y-bars x 2
.= 40 x 2 = 80 bars

5. Total length of Extra bar = length of each Extra bar in x-direction x no. of Extra bar in x-direction + length of each Extra bar in y-direction x no. of Extra bar in y-direction
.= 4.827' x 70 + 4.452 x 80
.= 694.05 Ft

(a). Total length of Main & Distribution bar for all Slabs :-

Slab-1	.= 1194.322 Ft
Slab-2	.= 1135.68 Ft
Slab-3	.= 1046.717 Ft
Slab-4	.= 995.325 Ft
Total	.= 4372.044 Ft

(b). Total length of Extra- bar for all Slabs :-

Slab-1	.= 785.92 Ft
Slab-2	.= 777.36 Ft
Slab-3	.= 703.318 Ft
Slab-4	.= 694.05 Ft
Total	.= 2960.648 Ft

Weight of Steel required for Slab Mesh :

1. Given Dia of Slab Mesh = 10mm Slab mesh = Ø 10mm@100mm or 4"

2. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 10^2 /531.36
.= 0.1881 kgs/Ft

3. Total weight of Steel required = weight/Ft x Total length main bars
.= 0.1881 x 4372.044
.= 822.381 kgs steel required of Ø 10mm

No. of Steel bars required of length 40Ft. :

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar = 10mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 10^2 /531.36
.= 0.1881 kgs/Ft

4. weight of each steel bar of length 40' = 0.1881 x 40 = 7.524 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 822.381 / 7.524
.= 109.301 or approximately equal to 110 bars of Ø10mm required.

For 109.301 steel bars the required wt of steel = 822.381 kgs (required wt of steel)
For 110 Steel bars the required wt of steel=7.524 x 110 = 827.64 kgs (Actual wt of steel)

Weight of Steel required for Extra-bar :

1. Given Dia of Extra-bar = 8mm Extra-bar = Ø 8mm@100mm or 4"

2. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 8^2 /531.36
.= 0.1204 kgs/Ft

3. Total weight of Steel required = weight/Ft x Total length of Extra-bar
.= 0.1204 x 2960.648'
.= 356.462 kgs steel required of Ø 8mm

No. of Steel bars required of length 40Ft. :

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar = 8mm
3. Weight of Steel bar in kgs / Ft $.= d^2/531.36$
   $.= 8^2/531.36$
   $.= 0.1204$ kgs/Ft

4. weight of each steel bar of length 40' = 0.1204 x 40 = 4.816 kgs

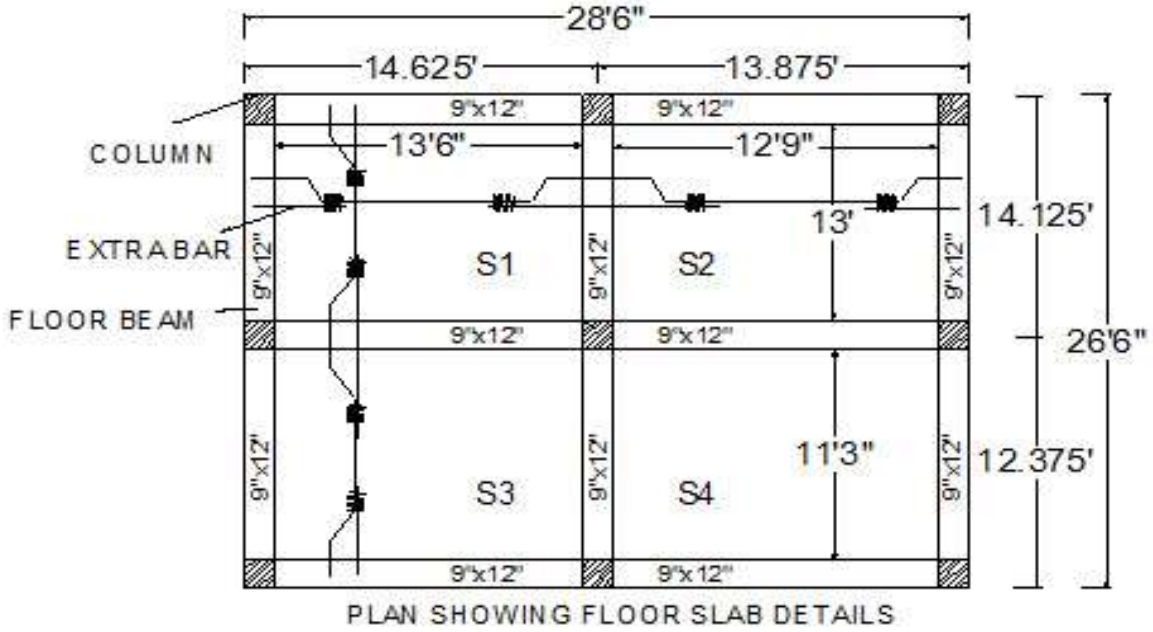
5. No. of Steel bars of length 40' required = Wt of steel required / wt of each steel bar
   .= 356.462 / 4.816
   .= 74.016 or approximately equal to 74 bars of Ø8mm required.

Bill of Quantities for Floor Slab reinforcement:-

BILLL OF QUANTITES FOR FLOOR SLAB REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø10mm	Kgs	48.00	827.640	110	39726.720	
2	Ø8mm	Kgs	48.00	356.462	74	17110.176	
					Total	56836.896	
				Add 10% wastage		5683.690	
			Add 5% Contingencies			2841.845	
					Total	65362.430	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

METHOD - 2 FOR SLAB REINFORCEMENT CALCULATIONS



PLAN SHOWING FLOOR SLAB DETAILS

(a). Slab mesh calculations :-

1. length of x-bar .= L - 1" - 1" + 0.42D x 4
.= 28'6" - 1" - 1" + 1.68D
.= 28'4" + 1.68 D
.= 28'4" + 1.68 x 4"
.= 28.333' + 1.68 x 0.333
.= 28.892 Ft

D = Depth of Slab - top cover - bottom cover
D = 6" - 1" - 1"
D = 4"

1" = 0.0833'
4" = 0.333'

2. length of y-bar .= L - 1" - 1" + 0.42D x 4
.= 26'6" - 1" - 1" + 1.68D
.= 26'4" + 1.68 D
.= 26'4" + 1.68 x 4"
.= 26.333' + 1.68 x 0.333
.= 26.892 Ft

Opp. Length = breadth of Slab - width of Floor beams
Opp.length = 26'6" - 9" x 3 = 24.25'

3. No. of x-bars .= (Opp.length / spacing) + 1
.= (24.25/0.333) + 1
.= 73.82 or approximately equal to 74 bars

Opp. Length = Length of Slab - width of Floor beams
Opp.length = 28'6" - 9" x 3 = 26.25'

4. No. of y-bars .= (Opp.length / spacing) + 1
.= (26.25/0.333) + 1
.= 79.82 or approximately equal to 80 bars

5. Total length of x-bar & y-bar = 28.892 x 74 + 26.892 x 80 = 4289.368 Ft

6. Weight of Steel bar in kgs / Ft .= d^2/531.36
Dia of Slab Mesh = 10mm .= 10^2 /531.36
.= 0.1881 kgs/Ft

7. Weight of Steel required for Slab Mesh = 0.1881 x 4289.368 = 806.830 kgs

8. weight of each steel bar of length 40' = 0.1881 x 40 = 7.524 kgs

9. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 806.830 / 7.524
.= 107.234 or approximately equal to 108 bars of Ø10mm required.

For 107.234 steel bars the required weight of steel = 806.830 kgs (required wt of steel)
For 108 Steel bars the required wt of steel=7.524 x 108 = 812.592 kgs(Actual wt of steel)

(b). Extra-bar calculations :-

8mm=? Ft	.= 0.3149" = ? Ft
since 1"=25.4mm	since 1ft = 12"
.= 8/25.4	.= 0.3149/12
.= 0.3149"	.= 0.0262ft

1. length of each Extra-bar in x-direction = (L/2) +50D x 4
.= (28.892/2) + 50 x 0.0262 x 4
.= 19.686 Ft

2. length of each Extra-bar in y-direction = (L/2) +50D x 4
.= (26.892/2) + 50 x 0.0262 x 4
.= 18.686 Ft

3. No. of Extra-bar in x-direction = 74
4. No. of Extra-bar in y-direction = 80
5. Total length of Extra-bar = 19.686 x 74 + 18.686 x 80 = 2951.644 Ft.

6. Weight of Steel bar in kgs / Ft .= d^2/531.36
Dia of Extra-bar = 8mm .= 8^2 /531.36
.= 0.1204 kgs/Ft

7. Weight of Steel required for Extra-bar = 0.1204 x 2951.644 = 355.377 kgs
8. weight of each steel bar of length 40' = 0.1204 x 40 = 4.816 kgs

9. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 355.377 / 4.816
.= 73.79 or approximately equal to 74 bars of Ø8mm required.

For 73.79 steel bars the required weight of steel = 355.377 kgs (required wt of steel)
For 74 Steel bars the required wt of steel = 4.816 x 74 = 356.384 kgs (Actual wt of steel)

(c). Bill of Quantities for Floor Slab reinforcement:-

BILLL OF QUANTITES FOR FLOOR SLAB REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø10mm	Kgs	48.00	812.592	108	39004.416	
2	Ø8mm	Kgs	48.00	356.384	74	17106.432	
					Total	56110.848	
				Add 10% wastage		5611.085	
			Add 5% Contingencies			2805.542	
					Total	64527.475	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-9 :-

For a given plan & Section Dwg. of Dog-leg Stair-case find

(i). Weight of Steel required for Main bars, Distribution bars, Extra bars and Hand Rail mesh. Thickness of Waist Slab and Landing = 6"

(ii). No. of Steel bars required, of length 40Ft

(iii). Bill of Quantities for Stair-case Reinforcement if Rate of steel /kg = 48.0 rupees.

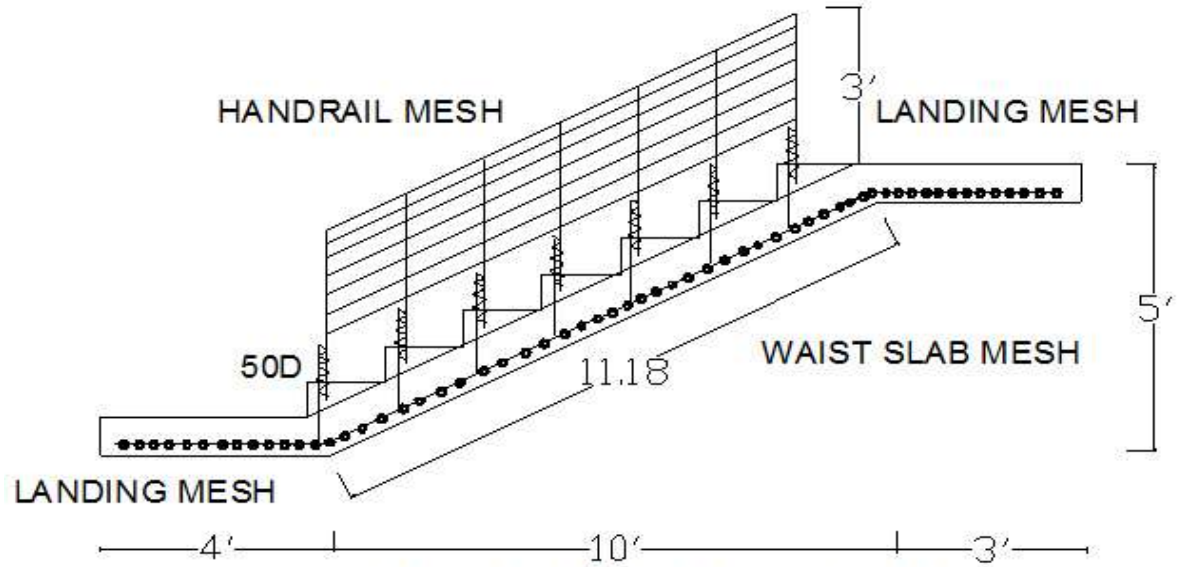
Reinforcement details :-

(a). Waist Slab mesh = Ø 10mm@100mm or 4"

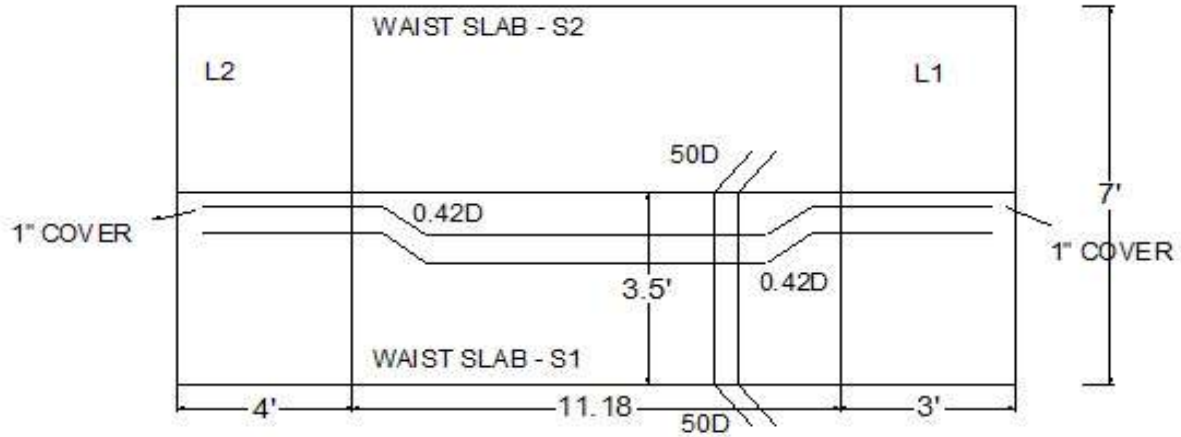
(b). Landing mesh = Ø 10mm@100mm or 4"

(c). Extra bar = Ø 8mm@ 100mm or 4"

(d). Handrail mesh = Ø 8mm@ 100mm or 4"



SECTION DWG.OF DOG-LEG STAIR CASE



PLAN OF DOG-LEG STAIR CASE

(i). Waist Slab (S1&S2) :-

Note:-

(a). while providing Steel mesh in waist slab , 1" concrete cover shall be deducted from each side of waist slab's x-bar and add over-lap length of 50D on each side of y-bar to join hand-rail mesh

(b). Each Crank Length = 0.42D

where D = Depth of Slab -Top and Bottom concrete cover

D = 6" - 1" - 1" = 4" or 0.333 Ft

(c). formula used to find, no. of bars = [opposite length / spacing] + 1

Given dia of main bar = 10mm

10mm = ? Ft .= 0.3937" = ? Ft

.= 10 / 25.4 .= 0.3937 / 12

.= 0.3937" .= 0.0328 Ft

1. length of x-bar .= 4' + 11.18' + 3' + 0.42D x 2 - 1" - 1"
.= 4' + 11.18' + 3' + 0.42 x 0.333 x 2 - 0.1666
.= 18.293 Ft

2. length of y-bar .= 3.5' + 50D x 2
.= 3.5' + 50 x 0.0328 x 2
.= 6.78' Ft

3. No. of x -bar . = [3'4" / 4"] + 1 L=3'6"-1"-1" = 3'4"
.= [3.333' / 0.333'] + 1
.= 11 bars

4. No. of y -bar .= [11.01 / 4"] + 1 L =11.18'-1"-1" = 11.01'
.= [11.01 / 0.333] + 1
.= 34.06
.= approximately equal to 34 bars

5. Total Length of Steel -bars = length of x -bar x no. of x -bars + length of y -bar x no. of y -bars

.= 18.293 x 11 + 6.78 x 34 = 431.743 Ft

6. Dia of bar for waist slab mesh in both direction = 10 mm

According to thumb rule :-

[i]. weight of steel bar in kgs / m = d^2 / 162 .= 10^2 / 162 = 0.617 kgs / m

[ii]. weight of steel bar in kgs / Ft = d^2 / 531.48 .= 10^2 / 531.48 = 0.188 kgs / Ft

8. Total weight required .= weight / Ft x Total length x no. of waist slab

.= 0.188 x 431.743 x 2

.= 162.335 kgs

(ii). Extra bar Calculations : Extra bar = Ø 8mm @ 100mm / 4"

8mm = ? Ft .= 0.3149 = ? Ft

.= 8 / 25.4 .= 0.3149 / 12

.= 0.3149" .= 0.0262 Ft

Note:- Extra bar is provided at a distance of L / 4 from corner of Slab

where L = length of x-bar including crank length

Length of each extra bar .= [L / 4] + over-lap length

.= [L / 4] + 50 D

1. Length of each extra bar in x-direction .= [11.459 / 4] + 50 x 0.0262

L = 11.18 + 0.42D x 2 .= 4.174 Ft

L = 11.18 + 0.42 x 0.333 x 2

L = 11.459 Ft

2. No. of Extra bar in x-direction .= No. of main bar in x-direction x 2

.= 11 x 2 = 22

3. Total length of Extra- bar in x- direction = length of Extra-bar x no. of Extra-bars

.= 4.174 x 22 = 91.828 Ft

4. Dia of Extra bar in x- direction = 8 mm ; Extra bar = Ø 8mm @ 100mm / 4"

According to thumb rule :-

[i]. weight of steel bar in kgs / m = d^2 / 162 .= 8^2 / 162 = 0.395 kgs / m

[ii]. weight of steel bar in kgs / Ft = d^2 / 531.48 .= 8^2 / 531.48 = 0.1204 kgs / Ft

5. Total weight required for Extra -bar = weight / Ft x Total length x no. of Waist Slabs

.= 0.1204 x 91.828 x 2

.= 22.112 kgs

(iii). Landing mesh (L1&L2) :-

Note:- while doing calculation of Reinforcement for Landing, no need to find length of x-bar as it has already added with waist slab x-bar length. All is need is to find length of y bar only.

1. length of y-bar .= 7' - 1" - 1"
.= 7' - 0.1666'
.= 6.983' Ft

2. No. of y -bar = [6.8333 / 4"] + 1
width of landing-1 = 3' .= [6.8333 / 0.333] + 1
width of landing-2 = 4' .= 21.52 or approximately equal to 22 bars
Total width = 3' + 4' = 7'
.= 7' - 1" - 1" [concrete cover]
.= 6.8333Ft

3. Total Length of y -bar .= length of y -bar x no. of y -bars
.= 6.983 x 22 = 153.626 Ft

According to thumb rule :-
[i]. weight of steel bar in kgs / m = d^2 / 162 .= 10^2 / 162 = 0.617 kgs / m
[ii]. weight of steel bar in kgs / Ft = d^2 / 531.48 .= 10^2 / 531.48 = 0.188 kgs / m

4. Total weight required for y -bar = weight / Ft x Total length
.= 0.188 x 153.626
.= 28.881 kgs

(iv). Hand-Rail mesh :-

1. length of x-bar .= 11.18' - 1" - 1"
.= 11.18' - 0.1666'
.= 11.013 Ft

2. length of y-bar .= 3' - 1" - 1"
.= 3' - 0.1666'
.= 2.833 Ft

3. No. of x -bar = [2'10" / 4"] + 1 L=3'-1"-1" = 2'10"
.= [2.8333 / 0.333'] + 1
.= 9.508 bars or approximately equal to 10 bars

4. No. of y -bar = [11.01 / 4"] + 1 L =11.18'-1"-1" = 11.01
.= [11.01 / 0.333] + 1
.= 34.06
.= approximately equal to 34 bars

5. Total Length of Steel bar = length of x -bar x no. of x -bars +
length of y -bar x no. of y -bars
.= 11.013 x 10 + 2.833 x 34 = 206.452 Ft

6. Dia of bar for Hand Rail mesh in both direction = 8 mm
According to thumb rule :-

[i]. weight of steel bar in kgs / m = d^2 / 162 .= 8^2 / 162 = 0.395 kgs / m
[ii]. weight of steel bar in kgs / Ft = d^2 / 531.48 .= 8^2 / 531.48 = 0.1204 kgs / Ft

Total weight of steel required . = weight / Ft x Total length x no. of Handrails
.= 0.1204 x 206.452 x 4
.= 99.427 kgs

Total weight of steel required:

1. S1&S2	10mm	162.335
2. landing 1&2	10mm	57.763
	Total	**220.098**
3. Extra bar	8mm	22.112
4. Handrail	8mm	99.427
	Total	**121.539**

No. of Steel bars required of length 40Ft. :

(a). Ø=10mm Required wt. of steel = 220.098kgs

1. Standard length of each steel bar = 40 Ft.

2. Dia of steel bar = 10mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 10^2 /531.36
.= 0.1881 kgs/Ft
4. weight of each steel bar of length 40' = 0.1881 x 40 = 7.524 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 220.098 / 7.524
.= 29.25 or approximately equal to 30 bars of Ø10mm required.

For 29.25 steel bars the required weight of steel = 220.098 kgs (required wt of steel)
For 30 Steel bars the required wt of steel = 7.524 x 30 = 225.72 kgs (Actual wt of steel)

(b). Ø = 8mm Required wt. of steel = 121.539kgs

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar = 8mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
.= 8^2 /531.36
.= 0.1204 kgs/Ft

4. weight of each steel bar of length 40' = 0.1204 x 40 = 4.816 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
.= 121.539 / 4.816
.= 25.23 or approximately equal to 26 bars of Ø8mm required.

For 25.23 steel bars the required weight of steel = 121.539 kgs (required wt of steel)
For 26 Steel bars the required wt of steel = 4.816 x 26 = 125.216 kgs (Actual wt of steel)

Bill of Quantities for Stair-case reinforcement:-

BILLL OF QUANTITES FOR STAIR-CASE REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø10mm	Kgs	48.00	225.720	30	10834.560	
2	Ø8mm	Kgs	48.00	125.216	26	6010.368	
					Total	16844.928	
				Add 10% wastage		1684.493	
			Add 5% Contingencies			842.246	
					Total	19371.667	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-10 :-

For a given plan & Section Dwg. of Kitchen Room find

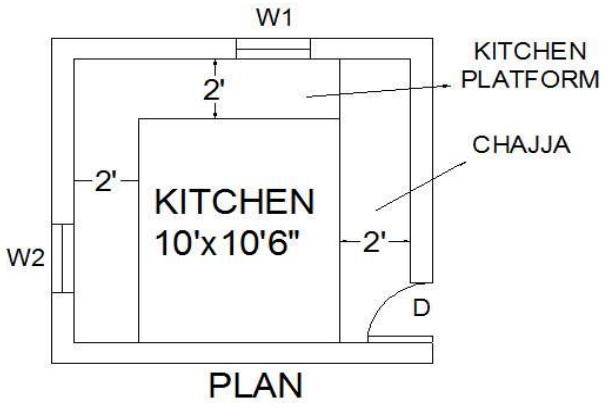
(i). Weight of Steel required for Kitchen Platform, Room Chajja, and Window sun-shade (arch type) (ii). No. of Steel bars required, of length 40Ft and

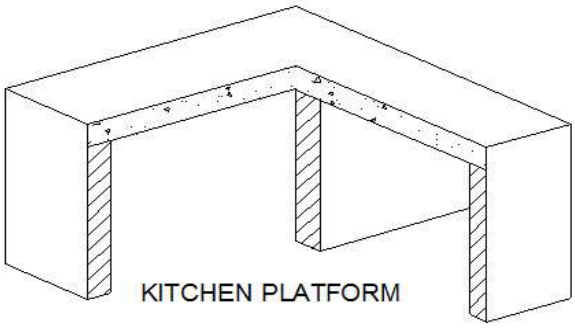
(iii). Bill of Quantities for Miscellaneous item Reinforcement.

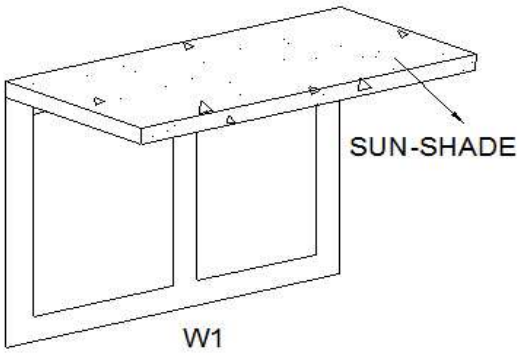
if Rate of steel /kg = 48.0 rupees.

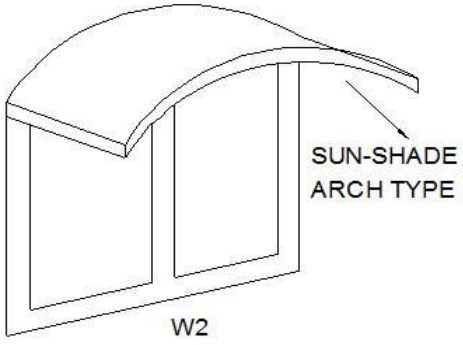
Reinforcement details :- Miscellaneous item mesh = Ø 8mm@100mm or 4"

Thickness = 4" for all Slabs wall thickness = 4"









Size of window-1 = 4' x 4' Size of window-2 = 4'6" x 4' (Arch Type)

Size of door = 3' x 7' Size of Chajja = 10'6" x 2'

Solution :-

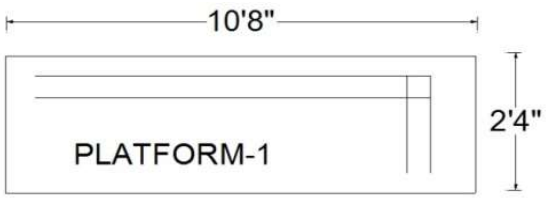
Note :- Dividing kitchen platform in to two parts and with each part add 4" bearing i.e., thickness of wall. Also deduct 1" concrete cover from both ends.

(a). Kitchen Platform :- Part-1:

1. length of x-bar .= length of platform + wall thickness from both end - 1" concrete cover from both side

.= 10' + 4" + 4" - 1" - 1"

.= 10'6" = 10.5'



2. length of y-bar .= Breadth of platform + wall thickness - 1" concrete cover from both side

.= 2' + 4" - 1" - 1"

.= 2'2" = 2.166'

3. No. of x-bars .= (Opp.length / spacing) + 1

.= (2.166'/0.333') + 1

.= 7.504 or approximately equal to 8 bars

4. No. of y-bars .= (Opp.length / spacing) + 1

.= (10.5'/0.333') + 1

.= 32.531 or approximately equal to 33 bars

5. Total length of bar = 10.5' x 8 + 2.166 x 33 = 155.478 Ft

Part-2:

1. length of x-bar .= length of platform + wall thickness - 1" concrete cover from both side

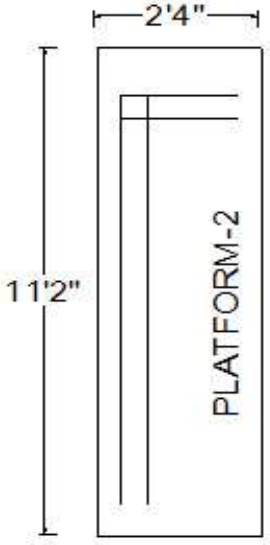
.= 2' + 4" - 1" - 1"

.= 2'2" = 2.166'

2. length of y-bar .= Breadth of platform + wall thickness from both end - 1" concrete cover from both side

.= 10'6" + 4" + 4" - 1" - 1"

.= 11'



3. No. of x-bars .= (Opp.length / spacing) + 1

.= (11'/0.333') + 1

.= 34.03 or approximately equal to 34 bars

4. No. of y-bars .= (Opp.length / spacing) + 1

.= (2.166'/0.333') + 1

.= 7.504 or approximately equal to 8 bars

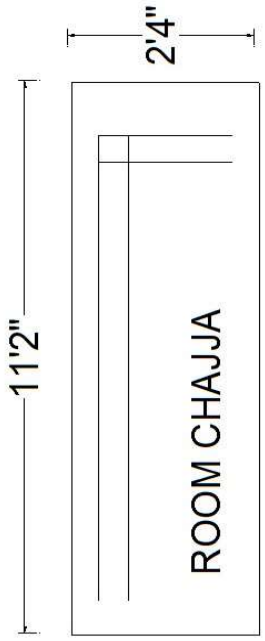
5. Total length of bar = 2.166' x 34 + 11' x 8 = 161.644 Ft

Total length of part-1 and part-2: = 155.478' + 161.644' = 317.122'

(b). Room chajja :-

1. length of x-bar .=length of Chajja + wall thickness - 1"concrete cover from both side
.= 2' + 4" - 1" - 1"
.= 2'2" = 2.166'

2. length of y-bar .= Breadth of Chajja + wall thickness from both end - 1" concrete cover from both side
.= 10'6" + 4" + 4" - 1" - 1"
.= 11'



3. No. of x-bars .= (Opp.length / spacing) + 1
.= (11'/0.333') + 1
.= 34.03 or approximately equal to 34 bars

4. No. of y-bars .= (Opp.length / spacing) + 1
.= (2.166'/0.333') + 1
.= 7.504 or approximately equal to 8 bars

5. Total length of x-bar & y-bar = 2.166' x 34 + 11' x 8 = 161.644 Ft

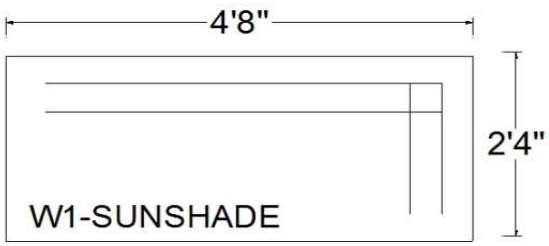
(c). Window Sun-shades :-

window-1: size = 4' x 4'

Note:- Add 4" bearing with length of window i.e., thickness of wall ,
Also deduct 1" concrete cover from both ends.

1. length of x-bar .= length of window + wall thickness from both end - 1" concrete cover from both side
.= 4' + 4" + 4" - 1" - 1"
.= 4''6" = 4.5'

2. length of y-bar .= projection length of sunshade + wall thickness - 1" concrete cover from both side
.= 2' + 4" - 1" - 1"
.= 2'2" = 2.166'



3. No. of x-bars .= (Opp.length / spacing) + 1
.= (2.166'/0.333') + 1
.= 7.504 or approximately equal to 8 bars

4. No. of y-bars .= (Opp.length / spacing) + 1
.= (4.5'/0.333') + 1
.= 14.51 or approximately equal to 15 bars

5. Total length of bar = 4.5' x 8 + 2.166 x 15 = 68.49 Ft

window-2: size = 4'6" x 4'

Note:- Add 4" bearing with length of window i.e., thickness of wall , Also deduct 1" concrete cover from both ends.

linear length of window = 4'6" + 4" + 4" =5'2"

Height of arch always 1Ft

Segmental Arc Length = L = (8B - 2R)/3

where 'R' = radius of circle

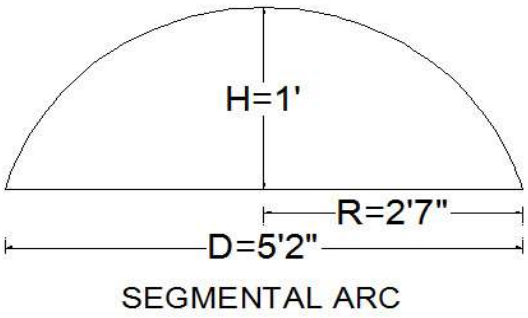
B' = V (R^2 +H^2)

"B' = V (2.583^2 +1^2)

.= 2.769

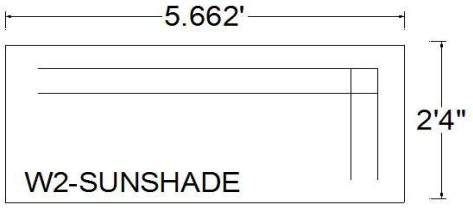
"L" = (8 x 2.769 - 2 x 2.583) / 3

.= 5.662 Ft



1. length of x-bar .= length of window - 1" concrete cover from both side
.= 5.662 - 1" - 1"
.= 5.662-0.166 = 5.496'

2. length of y-bar .= projection length of sunshade - 1" concrete cover from both side
.= 2' + 4" - 1" - 1"
.= 2'2" = 2.166'



3. No. of x-bars .= (Opp.length / spacing) + 1
.= (2.166'/0.333') + 1
.= 7.504 or approximately equal to 8 bars

4. No. of y-bars .= (Opp.length / spacing) + 1
.= (5.496'/0.333') + 1
.= 17.504 or approximately equal to 18 bars

5. Total length of bar = 5.496' x 8 + 2.166 x 18 = 82.956 Ft.

Total length for both window W1&W2 = 68.49 + 82.956 = 151.446 Ft.

(d). Total length for miscellaneous item :-

1. Kitchen platform .= 317.122
2. Room Chajja .= 161.644
3. Sun-shade .= 151.446

Total .=630.212 Ft.

Dia of bar for Miscellaneous item mesh in both direction = 8 mm

According to thumb rule :-

[i]. weight of steel bar in kgs / m = d^2 / 162 .= 8^2 / 162 = 0.395 kgs / m

[ii]. weight of steel bar in kgs / Ft = d^2 / 531.48 .= 8^2 / 531.48 = 0.1204 kgs / Ft

Total weight of steel required . = weight / Ft x Total length

.= 0.1204 x 630.212

.= 75.877 kgs

No. of Steel bars required of length 40Ft. :

Required wt. of steel = 75.877kgs

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar = 8mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36

.= 8^2 /531.36

.= 0.1204 kgs/Ft

4. weight of each steel bar of length 40' = 0.1204 x 40 = 4.816 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar

.= 75.877 / 4.816

.= 15.75 or approximately equal to 16 bars of Ø8mm required.

For 15.75 steel bars the required weight of steel = 75.877 kgs (required wt of steel)

For 16 Steel bars the required wt of steel = 4.816 x 16 = 77.056 kgs (Actual wt of steel)

Bill of Quantities for Miscellaneous item reinforcement:-

BILLL OF QUANTITES FOR MISCELLANEOUS ITEM REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
2	Ø8mm	Kgs	48.00	77.056	16	3698.688	
					Total	3698.688	
				Add 10% wastage		369.869	
			Add 5% Contingencies			184.934	
					Total	4253.491	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

Problem-11 :-

For a given plan & Section Dwg. of Sump (water tank below ground level) find

(i). Weight of Steel required

(ii). No. of Steel bars required, of length 40Ft

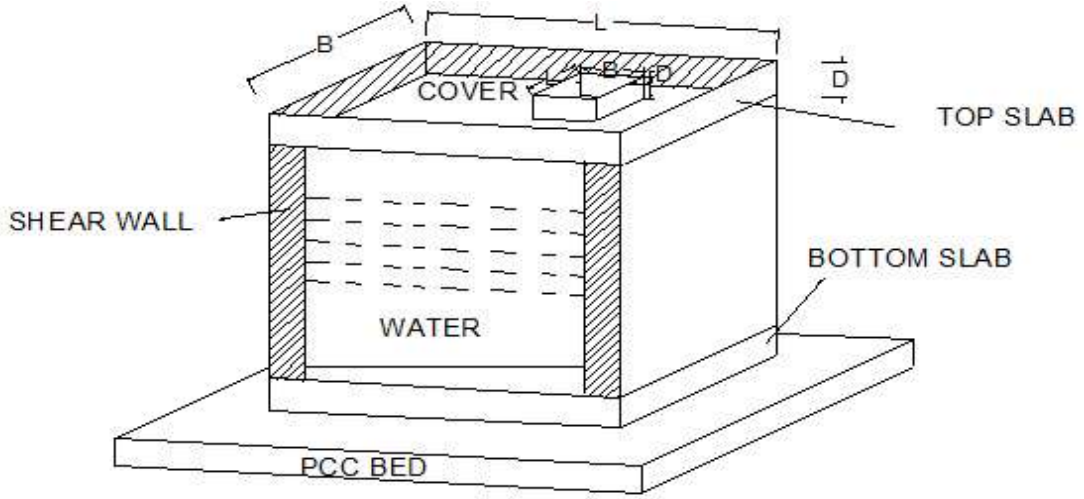
(iii).Bill of Quantities for Rectangular Sump Reinforcement if Rate of steel /kg=48.0 rupees.

Reinforcement Details :

Bottom and Top Slab mesh = Ø10mm@100mm

Shear Wall mesh = Ø12mm@100mm

Size of Sump = 10' x 8' x 6'6" Thickness of bottom and top slab = 6"

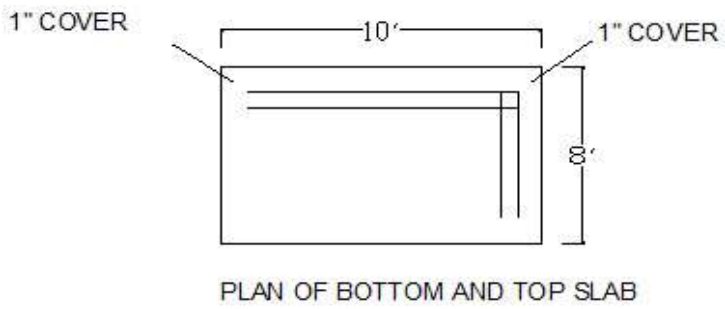


Solution :-

(i). Bottom and Top Slab mesh Calculations :-

Note:- while providing Steel mesh in bottom and top slab , 1" concrete cover shall be deducted from each side of Slab.

1. Length of x-bar .= 10' - 1" - 1"
.= 10' - 0.166'
.= 9.833 Ft



PLAN OF BOTTOM AND TOP SLAB

2. Length of y-bar .= 8' - 1" - 1"
.= 8' - 0.1666'
.= 7.833 Ft

3. No. of x-bars .= [7.833 / 0.333] +1
.= 24.52 approximately 25

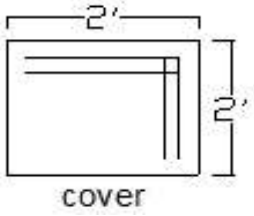
4. No. of y-bars .= [9.833 / 0.333] +1
.= 30.52 approximately 31

formula used to find, no. of bars = [opposite length / spacing] + 1

Note:- End bars will not be deducted from each side
of cover i.e., 7 -2 = 5 bars shall be considered.

5. Total length of x-bar and y-bar = 9.833 x 25 + 7.833 x 31 = 488.648 Ft

Deduction of Cover from top slab mesh :-



Length of x-bar .= 2'

Length of y-bar .= 2'

No. of x-bars .= [2' / 0.333] +1
.= 7

No. of y-bars .= [2' / 0.333] +1
.= 7

Total length of Steel bar for cover = 2 x 5 + 2 x 5 = 20 Ft

Total length of Steel bar required = 488.648 - 20 = 468.648 Ft

6. Dia of bar for Bottom and Top Slab mesh = 10 mm

According to thumb rule :- Slab mesh:Ø 10mm @ 100mm / 4"

[i]. weight of steel bar in kgs / m = d^2 / 162 .= 10^2 / 162 = 0.617 kgs / m

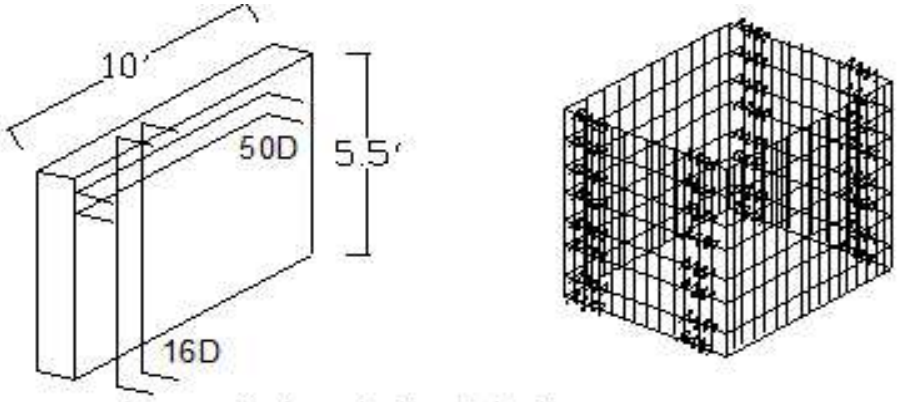
[ii]. weight of steel bar in kgs / Ft = d^2 / 531.48 .= 10^2 / 531.48 = 0.188 kgs / Ft

7. wt required for bottom and top slab mesh = weight / Ft x Total length x no. of Slabs

.= 0.188 x 468.648 x 2

.= 176.211 kgs

(ii). Shear Wall along horizontal axis :-



shear wall along horizantal axis

1. Length of x-bar .= 10' - 1" - 1" + 50D x 2

.= 10' - 0.1666' + 50 x 0.03937 x 2

.= 13.77 Ft

12mm = ? Ft

.=12 / 25.4

.= 0.472"

.= 0.472 / 12

.= 0.03937Ft

2. Length of y-bar = 5.5' + 3" + 3" + 16D x 2

.= 5.5 + 0.5' + 16 x 0.03937 x 2

.= 7.259 Ft

3. No. of x-bars = [5.333 / 0.333] +1

L=5.5'- 1" - 1" .= 17.015 approximately 17

L= 5.333Ft

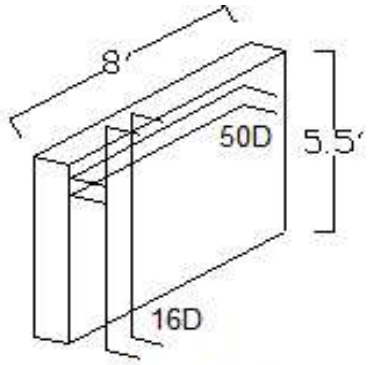
4. No. of y-bars = [9.833 / 0.333] +1

L=10'-1"-1" .= 30.52 approximately 31

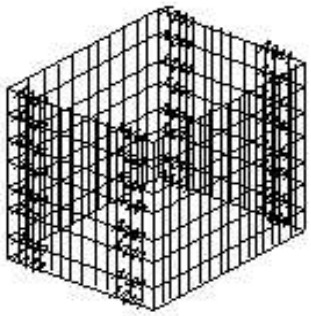
L= 9.833Ft

5. Total length of Steel bar = 13.77 x 17 + 7.259 x 31 = 459.119 Ft

(iii). Shear wall along vertical axis:-



shear wall along vertical axis



1. Length of x-bar .= 8' - 1" - 1"
.= 8' - 0.1666'
.= 7.833 Ft

2. Length of y-bar .= 5.5' + 3" + 3" + 16D x 2
.= 5.5 + 0.5' + 16 x 0.03937 x 2
.= 7.259 Ft

12mm = ? Ft
.=12 / 25.4
.= 0.472"
.= 0.472 / 12
.= 0.03937Ft

3. No. of x-bars = [5.333 / 0.333] +1
L=5.5'- 1" - 1" .= 17.015 approximately 17
L= 5.333Ft

4. No. of y-bars .= [7.833 / 0.333] +1
L=8'-1"-1" .= 24.52 approximately 25
L= 7.833Ft

5. Total length of x-bar = 7.833 x 17 + 7.259 x 25 = 314.636 Ft
Total length of Steel bars =
.=Shear wall along horizontal axis + shear wall along vertical axis
.= 459.119 + 314.636 = 773.755 Ft

6. Dia of bar for Shear wall mesh = 12 mm
According to thumb rule :-
[i]. weight of steel bar in kgs / m = d^2 / 162 .= 12^2 / 162 = 0.888 kgs / m
[ii]. weight of steel bar in kgs / Ft = d^2 / 531.48 .= 12^2 / 531.48 = 0.271 kgs / Ft

7. Total weight required .= weight / Ft x Total length x no. of walls
.= 0.271 x 773.755 x 2
.= 419.375 kgs

No. of Steel bars required of length 40Ft. :

(a). Ø = 10mm Required wt. of steel = 176.839 kgs

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar = 10mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
   .= 10^2 /531.36
   .= 0.1881 kgs/Ft

4. weight of each steel bar of length 40' = 0.1881 x 40 = 7.524 kgs

5. No. of Steel bars of length 40' required= wt of steel required / wt of each steel bar
   .= 176.839 / 7.524
   .= 23.503 or approximately equal to 24 bars of Ø10mm required.

For 23.503 steel bars the required weight of steel = 176.839 kgs (required wt of steel)
For 24 Steel bars the required wt of steel = 7.524 x 24 = 180.576 kgs (Actual wt of steel)

No. of Steel bars required of length 40Ft. :

(b). Ø = 12mm Required wt. of steel = 419.375 kgs

1. Standard length of each steel bar = 40 Ft.
2. Dia of steel bar = 12mm
3. Weight of Steel bar in kgs / Ft .= d^2/531.36
   .= 12^2 /531.36
   .= 0.271 kgs/Ft

4. weight of each steel bar of length 40' = 0.271 x 40 = 10.84 kgs

5. No. of Steel bars of length 40' required = wt of steel required / wt of each steel bar
   .= 419.375 / 10.84
   .= 38.68 or approximately equal to 39 bars of Ø12mm required.

For 38.68 steel bars the required weight of steel = 419.375 kgs (required wt of steel)
For 39 Steel bars the required wt of steel = 10.84 x 39 = 422.76 kgs (Actual wt of steel)

Bill of Quantities for Sump reinforcement:-

BILLL OF QUANTITES FOR SUMP REINFORCEMENT							
S.no.	Description	Unit	Rate/unit	Total Quantity		Total Amount	Remark
	Dia of bar	Kgs	in Rupees	Actual weight of	Required	in	
				Steel required	bars of	Rupees	
				in kgs	40' length		
1	Ø10mm	Kgs	48.00	180.576	24	8667.648	
2	Ø12mm	Kgs	48.00	422.760	39	20292.480	
					Total	28960.128	
				Add 10% wastage		2896.013	
			Add 5% Contingencies			1448.006	
					Total	33304.147	

Contingencies mean : Expenses which is likely to happen in future, which may happen or may not happen.

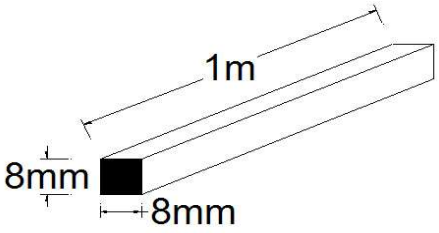
STEEL STRUCTURES CALCULATION

Density of Steel = 7850 kgs/m

Density of Steel = 0.00785 kgs/mm

Problem-1 :-

Find weight of Solid Square bar



Solution :-

Standard formulas :-

1. weight of Square Steel bar in kgs/m = volume of steel bar x Density of steel

dimension in metres .= 0.008 x 0.008 x 1.0 x 7850

.= 0.5024 kgs/m

2. weight of Square Steel bar in kgs/m = area of bar x Density of steel

dimension in mm .= 8 x 8 x 0.00785

.= 0.5024 kgs/m

According to thumb rule :

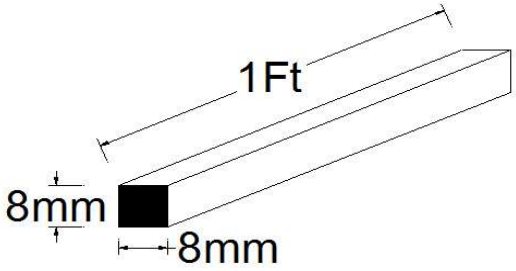
3. weight of Square Steel bar in kgs/m .= Area of bar / 127

dimension in mm .= (8 x 8) / 127

.= 0.503 kgs/m

Problem-2 :-

Find weight of Solid Square bar



Solution :-

weight of Square Steel bar in kgs/Ft .= Area of bar / 416.56

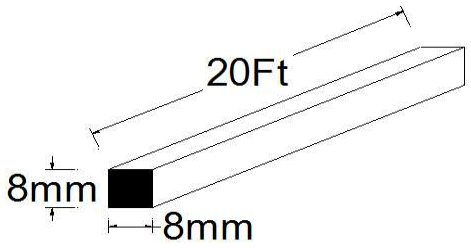
.= (8 x 8) / 416.56

.= 0.1536 kgs/ Ft

Problem-3 :-

Find weight of Solid Square bar

Solution :-



weight of Square Steel bar in kgs/Ft .= Area of bar / 416.56

.= (8 x 8) / 416.56

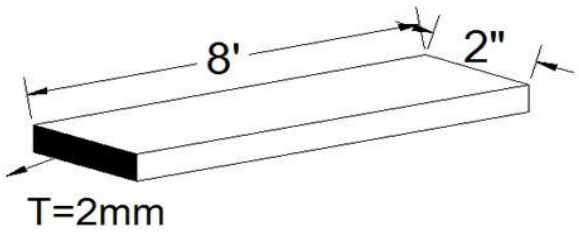
.= 0.1536 kgs/ Ft

length of solid square bar = 20'

Weight of Solid square bar = 0.1536 x 20' = 3.072 kgs

Problem-4 :-

Find weight of Flat plate



Solution :- since 1" = 25.4mm

25.4 x 2 = 50.8mm

section of Flat plate = 50.8mm x 2mm

weight of Steel bar in kgs/Ft .= Area of bar / 416.56

.= (50.8 x 2) / 416.56

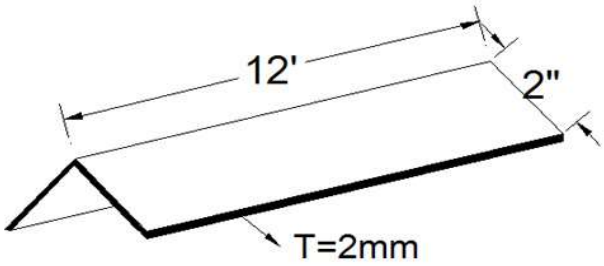
.= 0.243 kgs/ Ft

length of Flat plate = 8'

Weight of Flat plate = 0.243 x 8' = 1.944 kgs

Problem-5 :-

Find weight of angle plate



Solution :- since 1" = 25.4mm

25.4 x 4 = 101.6mm

section of Flat plate = 101.6mm x 2mm

weight of Steel bar in kgs/Ft .= Area of bar / 416.56

.= (101.6 x 2) / 416.56

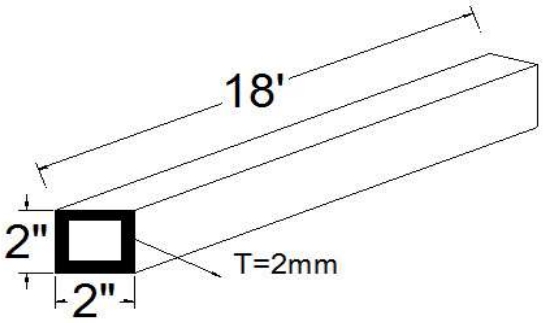
.= 0.487 kgs/ Ft

length of Angle plate = 12'

Weight of Angle plate = 0.487 x 12' = 5.844 kgs

Problem-6 :-

Find weight of Hollow square pipe



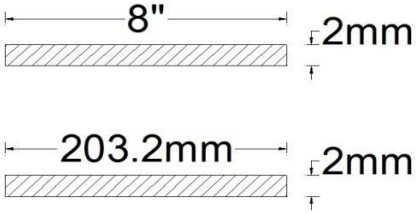
Solution :-

L = (L+B) x 2 = (2+2)x2 = 8"

since 1" = 25.4mm

8 x 25.4 = 203.2mm

Thickness of pipe = 2mm



section of Flat plate = 203.2mm x 2mm Section Dwg.

weight of Steel bar in kgs/Ft .= Area of bar / 416.56

.= (203.2 x 2) / 416.56

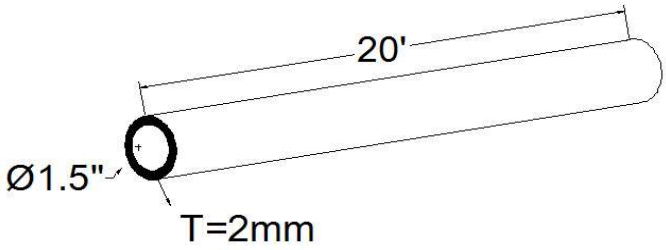
.= 0.975 kgs/ Ft

length of Hollow square pipe = 18'

Weight of Hollow square pipe = 0.975 x 18' = 17.55 kgs

Problem-7 :-

Find weight of Hollow round pipe



Solution :-

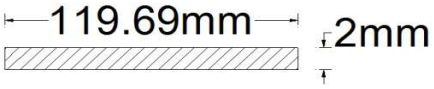
since 1" = 25.4mm

1.5" = 25.4 x 1.5 = 38.1mm

D = 38.1mm

R = 19.05mm

L = 2 x π x r = 2 x π x 19.05 = 119.69mm



Thickness of pipe = 2mm

section of Flat plate = 119.69mm x 2mm

weight of Steel bar in kgs/Ft .= Area of bar / 416.56

.= (119.69 x 2) / 416.56

.= 0.574 kgs/ Ft

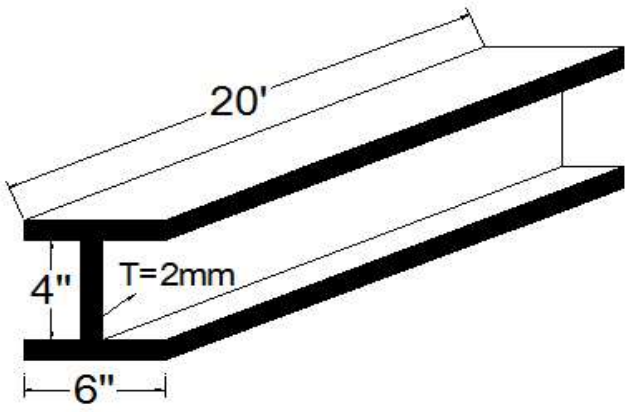
length of Round Hollow pipe = 20'

Weight of Round Hollow pipe = 0.574 x 20' = 11.48 kgs

Problem-8 :-

Find weight of i-Beam

Solution :-



1" = 25.4mm

6" = ?

6 x 25.4 = 152.4mm

4" = ?

4 x 25.4 = 101.6mm

Dividing c/s of i-beam in three parts

Area-1 = 152.4mm x 2mm = 304.8mm^2

Area-2 = 101.6mm x 2mm = 203.2mm^2

Area-3 = 152.4mm x 2mm = 304.8mm^2

Total area = 812.8mm^2

1. weight of i-beam in kgs/Ft .= Area of bar / 416.56
.= 812.8 / 416.56
.= 1.951 kgs/ Ft

2. weight of i-beam in kgs/ft .= Area of bar x Density of steel
Area in mm^2 .= 812.8 x 0.00785
.= 6.38kgs/m
.= 6.38 / 3.28
.= 1.945 kg/Ft

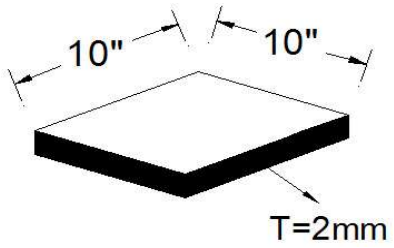
3. weight of i-beam in kgs/ft .= Area of bar x Density of steel
Area in m^2 .= 0.0008128 x 7850
.= 812.8/1000^2 .= 6.38kgs/m
.= 0.0008128 m^2 .= 6.38 / 3.28
.= 1.945 kg/Ft

length of i-beam = 20'

Weight of i-beam = 1.951 x 20 = 39.02 kgs

Problem-9 :-

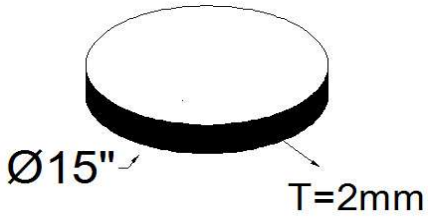
Find weight of Square plate



Solution :-

Weight of Square plate in kgs	.= Volume of plate x Density of steel
Dimension in metres	.= 0.254 x 0.254 x 0.002 x 7850
1" = 25.4mm	.= 1.01kgs
10" = 25.4 x 10 = 254mm	
254mm = 0.254m	

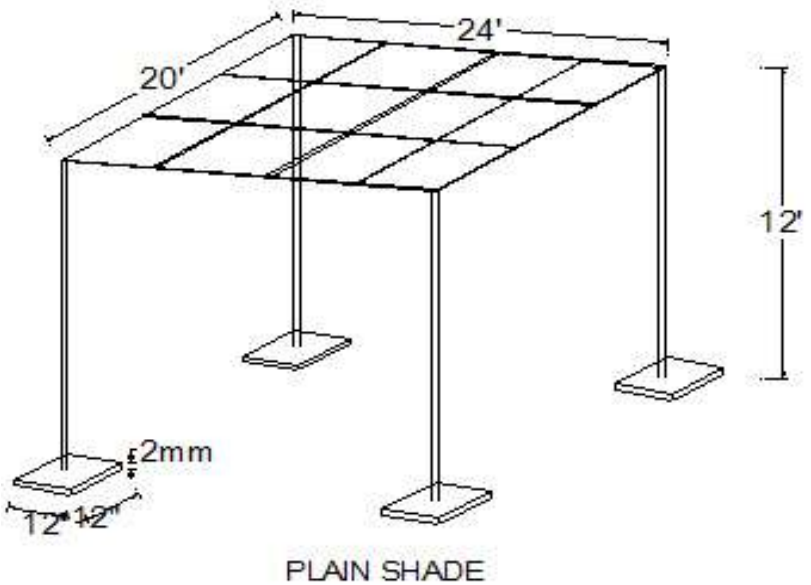
Problem-10 :- Find weight of Round plate



Solution :-

Weight of Round plate in kgs	.= Volume of plate x Density of steel
Dimension in metres	.= Area of platexthickness of platexDensity of steel
1" = 25.4mm	.= $(\pi/4) \times d^2$ x thickness of plate x density of steel
15" = 25.4 x 15 = 381mm	.= $(\pi/4) \times 0.381^2 \times 0.002 \times 7850$
381mm = 0.381m	.= 1.789kgs

Problem-11 :- From the given figure find



PLAIN SHADE

(i). Weight of Steel structure for pipes and square plates and

(ii). No. of pipes required to make this frame.

Section of pipe 2"x2" Thickness of pipe = 2mm

Square plate = 12" x 12" x 2mm

Solution :-

(a). Frame calculation:-

1. length of pipe in horizontal direction = 24'

   No. of pipes of length = 4

2. length of pipe in vertical direction = 20'

   No. of pipes of length = 5

3. Height of Column = 12'

   No. of pipes = 4

4. Total length = 24' x 4 + 20' x 5 + 12' x 4 = 244 Ft

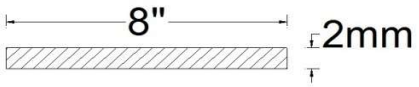
Section of pipe = 2"x2"

L = (2"+2") x 2 = 8" = 203.2mm Thickness = 2mm

L = (L+B) x 2 = (2"+2")x2 = 8"

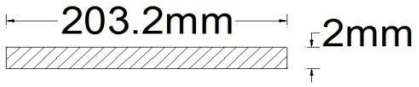
since 1" = 25.4mm

8 x 25.4 = 203.2mm



Thickness of pipe = 2mm

section of Flat plate = 203.2mm x 2mm



weight of Steel bar in kgs/Ft .= Area of bar / 416.56

.= (203.2 x 2) / 416.56

.= 0.975 kgs/ Ft

5. Total length of Hollow square pipe = 244'

Weight of Hollow square pipe required = 0.975 x 244' **= 237.9 kgs**

6. No. of pipes required = Total length required / length of each pipe

Standard length of Square pipe = 20'

.= 244 / 20

.= 12.2 pipes

(b). Square Plate :-

Size of Square plate = 12" x 12" x 2mm No. of Square plate = 4

Weight of Square plate in kgs .=Volume of plate x Density of steel x No. of plates

Dimension in metres .= 0.304 x 0.304 x 0.002 x 7850 x 4

1" = 25.4mm **.= 5.803 kgs**

12" = 25.4 x 12 = 304.8mm

304.8mm = 0.304m

(c). Total weight of Steel required = Weight of frame + Weight of Square plate

.= 237.9 + 5.803

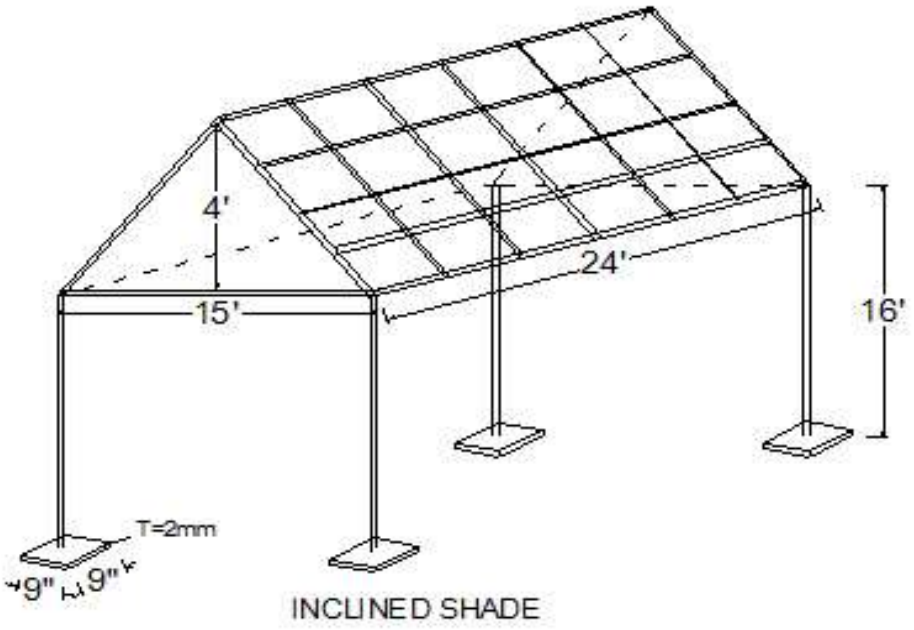
.= 243.703 kgs

Problem-11 :-

From the given figure find

(i). Weight of Steel structure for pipes and square plates and

(ii). No. of pipes required to make this frame.



Details: Section of pipe 1.5"x1.5" Thickness of pipe = 2mm

Square plate = 9" x 9" x 2mm

Solution :-

(a). Frame calculation:-

1. length of pipe in horizontal direction = 15'

   No. of pipes of length = 2

2. length of pipe in vertical direction = 24'

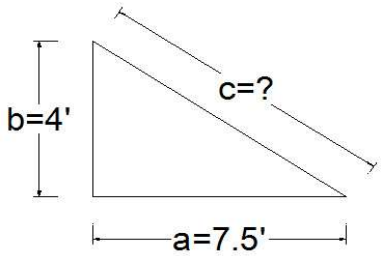
   No. of pipes of length = 9

3. Height of Column = 16'

   No. of pipes = 4

4. length of inclined pipe = 8.5 x 2 = 17'

   No. of pipes = 7



$c = \sqrt{(a^2 + b^2)}$

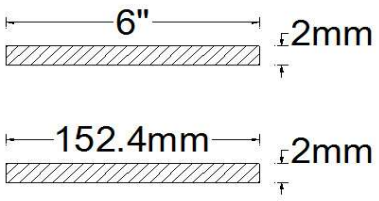
$c = \sqrt{(7.5^2 + 4^2)}$

c = 8.5

5. Total length = 15' x 2 + 24' x 9 + 16' x 4 + 17 x 7 = 429.0 Ft

Section of pipe = 1.5" x 1.5"

L = (L+B) x 2
L = (1.5" + 1.5") x 2 = 6" = 152.4mm
since 1" = 25.4mm
6 x 25.4 = 152.4mm
Thickness of pipe = 2mm
section of Flat plate = 152.4mm x 2mm



Thickness of pipe = 2mm

weight of Steel bar in kgs/Ft .= Area of bar / 416.56
.= (152.4 x 2) / 416.56
.= 0.731 kgs/ Ft

6. Total length of Hollow square pipe = 429'

7. Weight of Hollow square pipe required = 0.731 x 429 **= 313.599 kgs**

8. No. of pipes required = Total length required / length of each pipe
Standard length of Square pipe = 20'
.= 429 / 20
.= 21.45 pipes

(b). Square Plate :-

Size of Square plate = 9" x 9" x 2mm No. of Square plate = 4

Weight of Square plate in kgs .=Volume of plate x Density of steel x No. of plates
Dimension in metres .= 0.2286 x 0.2286 x 0.002 x 7850 x 4
1" = 25.4mm **.= 3.281 kgs**
9" = 25.4 x 9 = 228.6mm
228.6mm = 0.2286m

(c). Total weight of Steel required = Weight of frame + Weight of Square plate
.= 313.599 + 3.281
.= 316.88 kgs

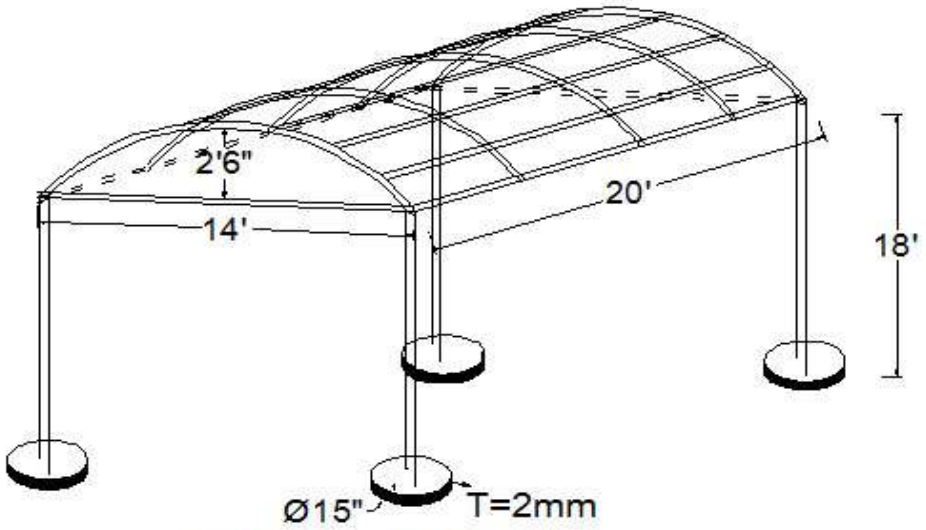
Problem-12 :- From the given figure find

(i). Weight of Steel structure for pipes and square plates and

(ii). No. of pipes required to make this frame.

Dia of pipe = 2" Thickness of pipe = 2mm

Dia of round plate = 15" thickness of plate = 2mm



ARCH TYPE SHADE

Solution :-

(a). Frame calculation:-

1. length of pipe in horizontal direction = 14'

   No. of pipes of length = 2

2. length of pipe in vertical direction = 20'

   No. of pipes of length = 9

3. Height of Column = 18'

   No. of pipes = 4

4. length of Arch pipe = 15.154'

   No. of pipes = 5

Segmental Arc Length = L = (8B - 2R)/3

where 'R' = radius of circle

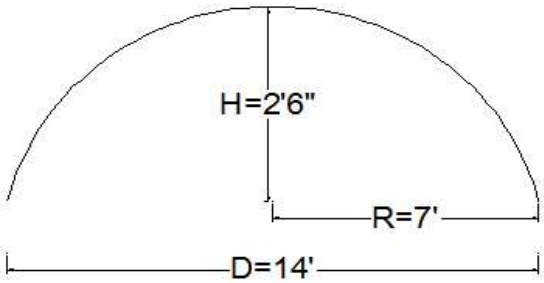
$B' = V(R^2 + H^2)$

$"B' = V(7^2 + 2.5^2)$

.= 7.433'

"L" = (8 x 7.433 - 2 x 7) / 3

.= 15.154' Ft



SEGMENTAL ARC

5. Total length = 14' x 2 + 20' x 9 + 18' x 4 + 15.154 x 5 = 355.77 Ft

Dia of pipe = 2" = 50.8mm Radius = 25.4mm
L = 2 x π x r = 2 x π x 25.4 = 159.59mm
Thickness of pipe = 2mm

section of Flat plate = 159.59mm x 2mm
weight of Steel bar in kgs/Ft .= Area of bar / 416.56
.= (159.59 x 2) / 416.56
.= 0.766 kgs/ Ft

6. Total length of Round Hollow pipe = 355.77'

7. Weight of Round Hollow pipe required = 0.766 x 355.77 **= 272.519 kgs**

8. No. of pipes required = Total length required / length of each pipe
Standard length of Round pipe = 20'
.= 355.77 / 20
.= 17.78 pipes

(b). Round Plate :-
Dia of Round plate = 15" ; T = 2mm No. of Round plate = 4

Weight of Round plate .=Volume of plate x Density of steel x No. of plates
Dimension in metres .= Area of plate x thickness of plate x Density of steel x no.s
1" = 25.4mm .= (π/4) x d^2 x thickness of plate x density of steel x no.s
15" = 25.4 x 15 = 381mm .= (π/4) x 0.381^2 x 0.002 x 7850 x 4
381mm = 0.381m **.= 7.159 kgs**

(c). Total weight of Steel required = Weight of frame + Weight of Round plate
.= 272.519 + 7.159
.= 279.678 kgs